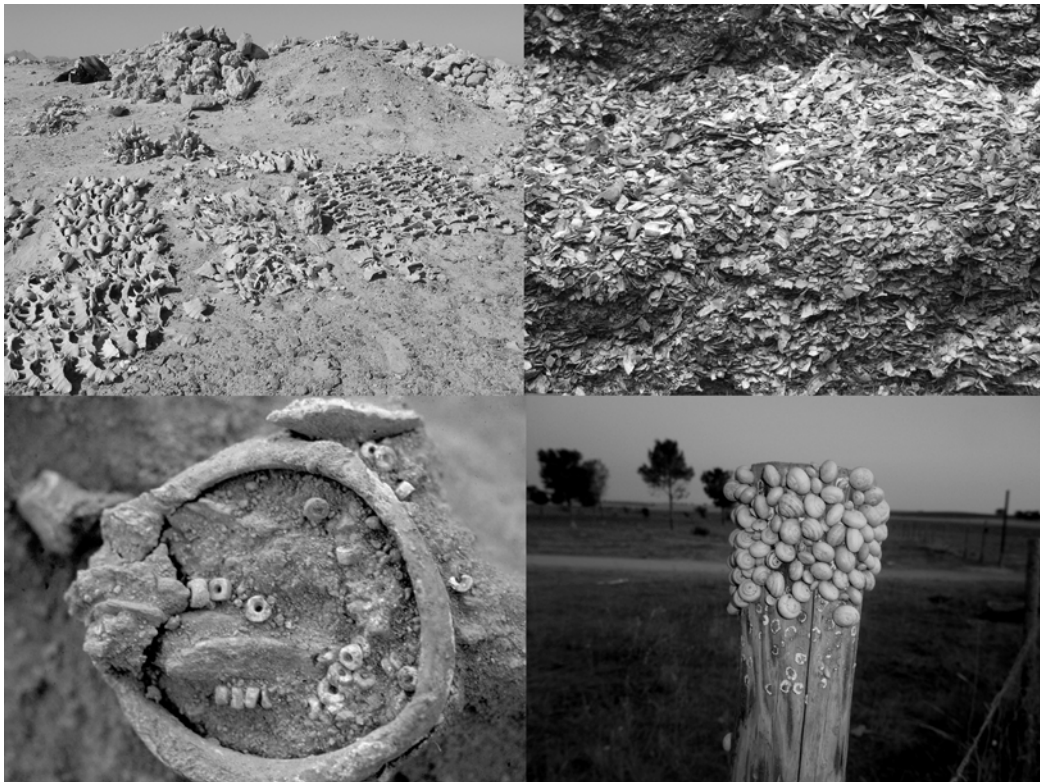


# Archaeomalacology: Shells in the Archaeological Record

Edited by

Katherine Szabó  
Catherine Dupont  
Vesna Dimitrijević  
Luis Gómez Gastélum  
Nathalie Serrand



BAR International Series 2666  
2014



Published by

Archaeopress  
Publishers of British Archaeological Reports  
Gordon House  
276 Banbury Road  
Oxford OX2 7ED  
England  
bar@archaeopress.com  
www.archaeopress.com

BAR S2666

*Archaeomalacology: Shells in the Archaeological Record*

© Archaeopress and the individual authors 2014

ISBN 978 1 4073 1308 5

Printed in England by Information Press, Oxford

All BAR titles are available from:

Hadrian Books Ltd  
122 Banbury Road  
Oxford  
OX2 7BP  
England  
www.hadrianbooks.co.uk

The current BAR catalogue with details of all titles in print, prices and means of payment is available free from Hadrian Books or may be downloaded from [www.archaeopress.com](http://www.archaeopress.com)

# Editors of the volume

**Katherine Szabó**

Associate Professor  
Centre for Archaeological Science  
School of Earth and Environmental Sciences  
University of Wollongong  
NSW 2522  
Australia  
*kat@uow.edu.au*

**Catherine Dupont**

Researcher  
CNRS UMR 6566 CReAAH « Centre de Recherche en Archéologie, Archéosciences, Histoire »  
CNRS, Université de Rennes 1, Rennes 2, Nantes, Le Mans et Ministère de la Culture  
Bâtiment 24-25, Université de Rennes I – Campus Beaulieu 74205CS, 35042 Rennes Cx  
France  
*catherine.dupont@univ-rennes1.fr*

**Vesna Dimitrijević**

Professor  
Laboratory for Bioarchaeology, Department of Archaeology  
Faculty of Philosophy, University of Belgrade  
Čika Ljubina 18-20, 11000 Belgrade  
Serbia  
*vdimitri@f.bg.ac.rs*

**Luis Gómez Gastélum**

Professor  
Departamento de Ciencias Sociales  
Centro Universitario de Tonalá  
Universidad de Guadalajara  
Mexico  
*gastelum@cencar.udg.mx*

**Nathalie Serrand**

Researcher  
In charge of archaeological research and field operations  
Inrap: Institut national de recherches archéologiques préventives  
Route de Dolé  
97113 Gourbeyre  
Guadeloupe  
*nathalie.serrand@inrap.fr*

With the technical assistance of Francis Bertin (CNRS, CReAAH, UMR6566, Université de Rennes I – Campus Beaulieu 74205CS, 35042 Rennes Cx France) for the page setting. Assistance with English language editing was provided by Luke Gliganic.



# Contents

<b>Preface</b> .....	5
----------------------	---

*Jean-Denis Vigne, Christine Lefèvre and Marylène Patou-Mathis*

<b>Introduction</b> .....	7
---------------------------	---

## **Acquisition and use of shell raw materials in prehistory**

1. The use of marine mollusc shells at the Neolithic site Shkarat Msaied, Jordan.....	9
<i>Aiysha Abu-Laban</i>	
2. Evaluating the role of molluscan shells assemblage recovered from Padri, a coastal Harappan settlement in Gujarat, India .....	19
<i>Arati Deshpande-Mukherjee and Vasant Shinde</i>	
3. The provenance and use of fossil scaphopod shells at the Late Neolithic/Eneolithic site Vinča – Belo Brdo, Serbia.....	33
<i>Vesna Dimitrijević</i>	
4. Perforated shells from an Early Mesolithic cemetery at La Vergne (Charente-Maritime, France): from acquisition to use and (sometimes) to wear .....	43
<i>Catherine Dupont, Luc Laporte, Patrice Courtaud, Henri Duday and Yves Gruet</i>	
5. Shell use in West Mexico and the Southwestern United States. An archaeological comparison.....	53
<i>Luis Gómez Gastélum</i>	
6. Occurrences of exogenous freshwater mussel shells (Bivalvia: Unionida) during the precolumbian ceramic age of the lesser Antilles .....	65
<i>Nathalie Serrand and Kevin S. Cummings</i>	
7. Dead from the sea: worn shells in Aegean prehistory .....	77
<i>Tatiana Theodoropoulou</i>	
8. Temporal changes in shell bead technologies based on Levantine examples.....	91
<i>Daniella E. Bar-Yosef Mayer</i>	
9. Shell tools in an early Neolithic coastal site in the Cantabrian region (Northern Spain): an experimental program for use-wear analysis at Santimamiñe cave .....	101
<i>David Cuenca-Solana, Igor Gutiérrez-Zugasti and Ignacio Clemente</i>	

## **Shell middens and shells as a food resource**

10. Shell Middens and the use of molluscs in the Late Middle Holocene in the Rio de la Plata: an ethnoarchaeological contribution.....	111
<i>Laura Beovide</i>	
11. Marine Resource Exploitation at Mersa/Wadi Gawasis (Red Sea, Egypt). The Harbour of the Pharaohs to the Land of Punt.....	121
<i>Alfredo Carannante, Rodolfo Fattovich and Carla Pepe</i>	

12. Shellfish gathering during the Iron Age and Roman times in the Northwest of the Iberian Peninsula.....	135
<i>Carlos Fernández-Rodríguez, Víctor Bejega-García and Eduardo González-Gómez-de-Agüero</i>	
13. Shellfishing and Horticulture in Prehistoric Northern New Zealand.....	147
<i>Tiffany James-Lee</i>	
14. Fisher-Gatherers of the Red Sea: Results of the Farasan Archipelago Shell Sites Project .....	163
<i>Matt Gregory Meredith Williams</i>	
15. Shell exploitation at Playa del Tesoro and Banderas Mexican Pacific coast.....	171
<i>José Beltrán</i>	
16. Oysters, Pheasants and Fine Foods. “High Class” Products in Alife (Campania, Italy) during and after the Roman Empire.....	181
<i>Alfredo Carannante, Salvatore Chilardi, Daniela Rebbecchi, Annalisa Del Santo, Roberto Vedovelli</i>	
17. Archaeozoological analysis of molluscan fauna from the Late Bronze Age stratum of site 4 of Tell Jenin (Northern West Bank, Palestine).....	195
<i>Ademar Ezzughayyar, Khalid M. Swaileh</i>	
18. Acquisition and management of marine invertebrates resources on a pre-Roman coastal settlement : the site of Dossen Rouz (Locquémeau-Trédrez, Brittany, France).....	203
<i>Caroline Mougne, Catherine Dupont, Anna Baudry, Laurent Quesnel and Marie-Yvane Daire</i>	

### **Shells as indicators of palaeoenvironment, site formation and transformation**

19. Dynamics of palaeoenvironmental conditions over the last millennia by archaeomalacological data (on example of ADK-009 shell midden, Adak Island, Aleutian Islands).....	217
<i>Zhanna Antipushina</i>	
20. Biostratigraphy of shells and climate changes in the Cantabrian region (Northern Spain) during the Pleistocene-Holocene transition .....	225
<i>Igor Gutiérrez-Zugasti and David Cuenca-Solana</i>	
21. Deposits of terrestrial snails: Natural or Anthropogenic processes?.....	235
<i>Eloísa Bernáldez-Sánchez and Esteban García-Viñas</i>	
22. Micro-Freshwater Gastropod Remains from Çatalhöyük, Turkey: Preliminary Environmental Observations.....	245
<i>Burçin Aşkıım Gümüş and, Daniella E. Bar-Yosef Mayer</i>	
23. Mollusc Shells from Archaeological Building Materials.....	253
<i>Matt Law</i>	

# Preface

This publication is one of the volumes of the proceedings of the 11th International Conference of the International Council for Archaeozoology (ICAZ), which was held in Paris (France) 23rd-28th August 2010. ICAZ was founded in the early 1970s and ever since has acted as the main international organisation for the study of animal remains from archaeological sites. The International Conferences of ICAZ are held every four years, with the Paris meeting – the largest ever – following those in Hungary (Budapest), the Netherlands (Groningen), Poland (Szczecin), England (London), France (Bordeaux), USA (Washington, DC), Germany (Constance), Canada (Victoria), England (Durham) and Mexico (Mexico City). The next meeting is scheduled to be held in Argentina in 2014. The Paris conference – attended by some 720 delegates from 56 countries – was organised as one general and thirty thematic sessions, which attracted, in addition to archaeozoologists (zooarchaeologists), scholars from related disciplines such as bone chemistry, genetics, morphometry, anthropology, archaeobotany, and mainstream archaeology. This conference was also marked by the involvement in the international archaeozoological community of increasing numbers of individuals from countries of Latin America and of South and East Asia.

As nearly 800 papers were presented at the Paris conference in the form of either oral or poster presentations, it was not possible to organize a comprehensive publication of the proceedings. It was left up to the session organizers to decide if the proceedings of their session would be published and to choose the form such a publication would take. A comprehensive list of publication plan of the 11th ICAZ International Conference is regularly updated and posted on the ICAZ web site.

The conference organizers would like to take this opportunity to thank the Muséum national d'Histoire naturelle, the Université Pierre et Marie Curie, the Centre national de la Recherche scientifique and the ICAZ Executive Committee for their support during the organization of the conference, and all session organisers – some of them being now book editors – for all their hard work. The conference would not have met with such success without the help of the Alpha Visa Congrès Company, which was in charge of conference management. Further financial help came from the following sources: La Région Île-de-France, the Bioarch European network (French CNRS; Natural History Museum Brussels; Universities of Durham, Aberdeen, Basel and Munich), the LeCHE Marie Curie International Training Network (granted by the European Council), the Institute of Ecology and Environment of the CNRS, the Institut National de Recherche en Archéologie Préventive (INRAP), the European-Chinese Cooperation project (ERA-NET Co-Reach), the Centre National Interprofessionnel de l'Économie Laitière (CNIEL) and its Observatory for Food Habits (OCHA), the Ville de Paris, the Société des Amis du Muséum, the French Embassies in Beijing and Moscow, the laboratory "Archaeozoology-Archaeobotany" (UMR7209, CNRS-MNHN), the School of Forensics of Lancaster, English Heritage and private donors.

*Jean-Denis Vigne, Christine Lefèvre and Marylène Patou-Mathis  
Organizers of the 11th ICAZ International Conference*

## 17 - ARCHAEOZOOLOGICAL ANALYSIS OF MOLLUSCAN FAUNA FROM THE LATE BRONZE AGE STRATUM OF SITE 4 OF TELL JENIN (NORTHERN WEST BANK, PALESTINE)

Ademar EZZUGHAYYAR,

Department of Biology and Biochemistry, Birzeit University, P. O. Box 14, West Bank, Palestine,  
ademar@birzeit.edu

Khalid M. SWAILEH

Department of Biology and Biochemistry, Birzeit University, P. O. Box 14, West Bank, Palestine,  
kswaileh@birzeit.edu

**Abstract:** Molluscan shells were collected and analyzed from the Late Bronze Age stratum of Tell Jenin (West Bank, Palestine). A total of 2922 (MNI) shells were identified from the stratum and found to be belonging to 44 species of terrestrial, freshwater and marine molluscs. Additionally, a total of 6200 unknown shell fragments were collected from the same stratum. Landsnail shells belonging to 18 species and having a total of 1974 specimens were clearly dominant over freshwater molluscs (17 species and 916 specimens) and marine Mediterranean molluscs (9 species and 32 specimens). Among terrestrial molluscs, *Calaxis hierosolymarum* and *Cecilioides genezarehensis* (family Ferrussaciidae) were the most dominant landsnail of that Age. Freshwater molluscs were dominated by *Semisalsa contempta* and *Pseudamnicola solitaria*, whereas Mediterranean snails were dominated by *Glycymeris violascens* and *Glycymeris pilosus*. The construction phase of the site (occupation phase) contained more specimens of molluscs than the destructive (abandonment) phase. The molluscan study and analysis revealed paleoclimatic variations during the Late Bronze Age. It also reflected different patterns of trade exchange, food sources, and the use of molluscan shells as artifacts, including their use as ornaments, in traditional and ritual activities by the inhabitants of the site.

**Keywords:** Tell Jenin, Late Bronze Age, Molluscan Fauna, Paleoclimatic Variations.

### Introduction

The Tell Jenin (Jenin city, West Bank-Palestine) (UTM 1785-2075) is located about 40 km east of the Mediterranean coast and 100 km north of Jerusalem (Ezzughayyar, Al-Zawahra, and Salem 1996; Glock 1987). This site is found at 150 m altitude (fig. 17-1). Its annual precipitation is about 500 mm/year, with an average temperature of 20° C (10° C in January and 30° C in August). According to reports from field inspectors of the Department of Antiquities during the British Mandate, Tell Jenin was first identified by Albright (1926) as the site of an ancient town on top of which was a modern cemetery and a threshing floor. The Tell is also known as Tell el-Nawar (Arabic word for gypsies), because of annual nomad encampments on the mound prior to 1948. Precise stratigraphic knowledge of the archaeological history of the site and the region of Jenin began in 1977 with Birzeit University salvage excavations at four sites of the Tell (Glock 1979; 1987). The excavations and surveys of site 4 (1980- 1983) indicate that the most ancient occupation of the Tell dated to Late Neolithic to early Chalcolithic period (7000-4000 BC).

Shells of mollusks from marine and freshwater environments have been used by humans since about 50,000 BP for food (Volman 1978), ornaments (Bar-Yosef 1989, 1991; Bar-Yosef Mayer 2005a, 2008; Biggs 1963; Claassen 1991; Goring-Morris 1989) and sometimes as

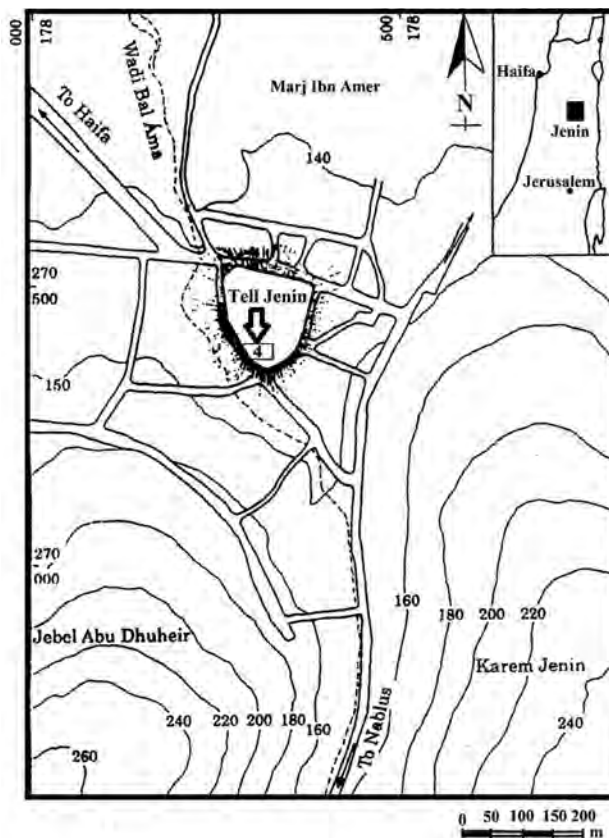


Figure 17-1. Sketch map showing the location of Tell Jenin and the archaeological Site 4 excavated by Birzeit University.



currency in trade (Reese 1991a). Shells are found in a great many archaeological sites, in many contexts, such as burials, food preparation and craft working areas, storage installations and refuse heaps. As ornaments they were used for necklaces, bracelets, clothing decorations or inlay in artifacts of other materials. Shells were probably collected directly from the sea or river or by exchange, or as gifts (Bar-Yosef Mayer 2008; Reese 1991a).

The Late Bronze Age stratum was chosen for analysis as it contains the majority of molluscan faunal remains in the site. Moreover, this stratum was deserted and faced severe erosion cycles (the destruction phase), separating the two occupation phases where ash and seeds were recovered.

The purpose of this study is to present a systematic and quantitative analysis of marine, freshwater shells and land snails, as each group may represent a different paleoclimatic line of evidence in prehistoric times. Following from this, the reconstruction of ecological or environmental parameters within the Late Bronze Age can be isolated. In addition, study of the molluscs could reveal the patterns of trade and exchange, food procurement, and traditional activities of the inhabitants of the site (1550-1200 BC).

### Materials and Methods

Samples of the snail shell-bearing beds of the Late Bronze Age (stratum IV) from Site 4 were sieved under water with fine-meshed sieves (2 mm) and left to dry. About 300 samples of soil (8 liters each) were floated to retrieve imaterial for microanalysis. Shells (complete, broken, and fragments) obtained by sieving were picked out by hand for later analysis. The minimum number of individuals (MNI) was calculated by using the “state of preservation” and “shell part” factors. That is, the number of complete shells of each species was counted and the number of the most frequent shell part (apex, siphonal canal or umbo) was added to it.

Molluscan specimens were then identified and classified by taxa (genus and species). Statistical analysis, as well as provenance including area, locus, basket and period, were entered into database programs (D-base IV and Excel). Ordinarily the pottery excavated was washed, sorted and recorded each day. The outline of the occupational history of Tell Jenin is based on these field readings of the ceramic material. Nomenclature of the marine specimens was done according to Abbot and Dance (1982), Sharabati (1984), Tornaritis (1987) and Barash and Danin (1982). The nomenclature of the terrestrial and freshwater molluscs followed Mienis (1982, 1983 and 1986a), Schütt (1983), and Heller (1993). The identification of specimens to species level was finalized by comparing them to the molluscan collection at the Department of Biology (Birzeit University).

### Results

The molluscan specimens derived from the Late Bronze Age stratum at Tell Jenin consisted of 2922 specimens (MNI) and 6200 unidentified fragments that were too small to be categorized

Molluscs	No. of specimen
<b>Freshwater Gastropoda</b>	
<b>Family Thiaridae</b>	
<i>Melanoides tuberculata</i> (Müller, 1774)	29
<b>Family Melanopsidae</b>	
<i>Melanopsis buccinoidea</i> (Olivier, 1801)	133
<i>Melanopsis costata</i> (Olivier, 1804)	74
<i>Melanopsis cerithiopsis</i> Bourguignat, 1856	13
<b>Family Neritidae</b>	
<i>Theodoxus jordani jordani</i> (Sowerby, 1836)	123
<b>Family Cochliopidae</b>	
<i>Semisalsa contempta</i> (Dautzenberg, 1894)	103
<i>Semisalsa galilaea</i> (Preston, 1913)	10
<b>Family Hydrobiidae</b>	
<i>Pseudammicola solitaria</i> Tchernov, 1971	148
<i>Orientalina gaillardoti</i> (Bourguignat, 1856)	178
<i>Islamia mienisi</i> (Schütt, 1991)	3
Opercula of unspecified species	10
<b>Family Valvatidae</b>	
<i>Valvata saulcyi</i> Bourguignat, 1853	1
<b>Family Planorbidae</b>	
<i>Bulinus truncatus</i> (Audouin, 1826)	18
<i>Planorbis planorbis antiochianus</i> Locard, 1883	16
<i>Gyraulus piscinarum</i> (Bourguignat, 1852)	40
<b>Freshwater Bivalvia</b>	
<b>Family Unionidae</b>	
<i>Unio terminais</i> Bourgnignat, 1852	14
<b>Total</b>	<b>916</b>

Table 17-1. Taxonomic composition of freshwater mollusc shells from Site 4 in Tell Jenin from the late Bronze Age stratum.



Figure 17-2. Some examples of freshwater mollusc shells: A: *Unio terminalis*; B; *Melanopsis buccinoidea*; C: *Melanoides tuberculata*; D: *Theodoxus jordani jordani*.

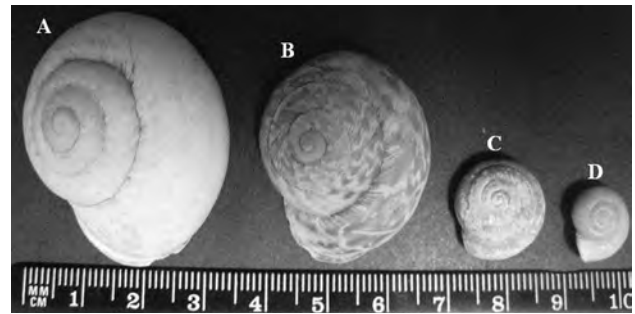


Figure 17-3. Some examples of landsnails. A: *Levatina spiriplana caesareana*; B: *Helix engeddensis*; C: *Sphincterochila cariosa*; D: *Monacha syriaca*.

Molluscs	No. of specimen
<b>Terrestrial Gastropoda (Land snails)</b>	
<b>Family Enidae</b>	
<i>Euchondrus septemdentatus</i> (Roth, 1839)	126
<i>Euchondrus</i> sp.	41
<b>Family Ferrussaciidae</b>	
<i>Calaxis hierosolymarum</i> (Roth, 1855)	791
<i>Cecilioides genezarethensis</i> Forcart, 1981	663
<i>Cecilioides judaica</i> (Mousson, 1861)	4
<b>Family Pristolomatidae</b>	
<i>Vitrea contracta</i> (Westerlund, 1871)	68
<b>Family Sphincterochilidae</b>	
<i>Sphincterochila cariosa</i> (Olivier, 1804)	1
<b>Family Hygromiidae</b>	
<i>Trochoidea simulata</i> (Ehrenberg, 1831)	12
<i>Trochoidea tuberculosa</i> (Conrad, 1852)	5
<i>Xeropicta carmelensis</i> Forcart, 1976)	7
<i>Xeropicta vestalis</i> (Pfeiffer, 1841)	50
<i>Monacha syriaca</i> (Ehrenberg, 1939)	30
<i>Monacha obstructa</i> (Pfeiffer, 1842)	32
<b>Family Pyramidulidae</b>	
<i>Pyramidula rupestris hierosolymitana</i> (Bourguignat, 1852)	30
<b>Family Trisexodontidae</b>	
<i>Caracollina lenticula</i> (Michaud, 1831)	51
<b>Family Helicidae</b>	
<i>Levatina spiriplana caesareana</i> (Mousson, 1854)	36
<i>Helix engaddensis</i> Bourguignat, 1852	27
<b>Total</b>	<b>1974</b>

Table 17-2. Systematic analysis of terrestrial mollusc shells from Site 4 in Tell Jenin from the late Bronze Age stratum.

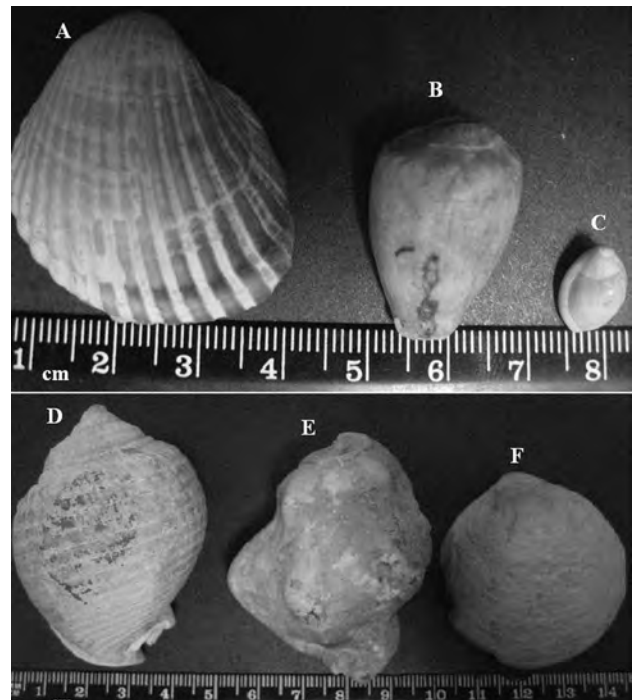


Figure 17-4. Some examples of marine mollusc shells. A: *Cerastoderma glaucum*; B: *Conus mediterraneus*; C: *Nassarius gibbosulus*; D: *Phalium granulatum*; E: *Bolinus brandaris*; F: *Glycymeris violascens*.

### Systematic analysis

In order to classify specimens to the species levels, shells were examined carefully by eye or with the help of a compound microscope (magnification 2x-4x). Results obtained are summarized in tables 17-1 to 17-3. In addition, some shells representing the three groups of molluscs were photographed and are shown in fig. 17-2 to 17-4. The distribution of specimens by habitat is shown in fig. 17-5. Manipulated shells are shown in fig. 17- 6.

Molluscs	No. of specimen
<b>Marine Bivalvia (Pelecypoda)</b>	
<b>Family Glycymerididae</b>	
<i>Glycymeris pilosus</i> (Linnaeus, 1767)	6
<i>Glycymeris violascens</i> (Lamarck, 1819)	9
<b>Family Cardiidae</b>	
<i>Cerastoderma glaucum</i> (Poiret, 1789)	4
<b>Marine Gastropoda</b>	
<b>Family Conidae</b>	
<i>Conus mediterraneus</i> Hwass, 1792	3
<b>Family Cassidae</b>	
<i>Phalium granulatum undulatum</i> (Gmelin, 1791)	3
<b>Family Nassariidae</b>	
<i>Nassarius gibbosulus</i> (Linnaeus, 1758)	2
<b>Family Muricidae</b>	
<i>Bolinus brandaris</i> (Linnaeus, 1758)	2
<b>Scaphopoda</b>	
<b>Family Dentaliidae</b>	
<i>Dentalium</i> sp.	3
<b>Total</b>	<b>32</b>
Unidentified Fragments	6200

Table 17-3. Taxonomic composition of marine mollusc shells from Site 4 in Tell Jenin from the late Bronze Age stratum.

## Discussion

Land snails are the only group of molluscs which might have entered the site by themselves, and were not necessarily brought in by humans. Their dominance in this stratum may reflect a very short human occupation, since they are typical of deserted sites while marine and freshwater shells were more frequent in the construction phase (fig. 17-5). These observations are in accordance with those of Bar-Yosef and Heller (1987) and Ezzughayyar, Al-Zawahra, and Salem (1996). *Monacha* and *Xeropicta* species might have entered the site after it was deserted and covered by weeds. *Monacha* species are common today throughout Mediterranean regions, and where the climate is cooler and receives more rain in the hilly region, the shells become larger. *Monacha* (fig. 17-3D) is an annual species that lives only for one year and its size depends largely on the amount of rainfall during the winter period. Thus, it could reflect paleoclimatic variation in the studied prehistoric sites (Heller and Tchernov 1978). For example, the average diameter of *Monacha* shells from Tell Jenin archaeological site studied was 6.2 mm, whereas the present mean diameter of the snail's shell is 9.2 mm corresponding to 400 mm

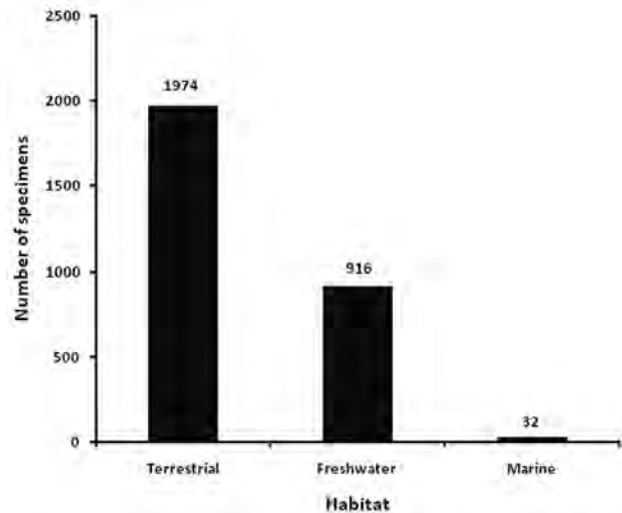


Figure 17-5. Distribution by habitat of molluscs found in the Late Bronze Age stratum of Tell Jenin.

annual rainfall. This means that the climate of the Late Bronze Period was less moist.

Biggs (1963) recovered some fragments of *Monacha*, *Sphincterochila* and *Trochoidea* (*Xerocrassa*) from the Alter of the Sanctuary at En-Gedi and dated them to the 4<sup>th</sup> Millennium BC. Schütt (1983) has described a closely related species, *M. syriaca*, from various sites in Jordan like north Shuna, Ajlun and Irbid.

*Pyramidula hierosolymitana* has been found in Cyprus, Syria, Lebanon, Palestine, Israel and Jordan. It is widely distributed in the mountains, especially lichen and algae covered sides of the rocks, where the snails are camouflaged by a thin layer of mud covering their shells (Mienis 1986a).

*Calaxis* and *Ceciliodes* species are tiny subterranean land snails which were concentrated in specific loci (116, 189, 213, 220 and 240) of abandonment phases of the site. These loci are tombs that contain a large quantity of bone fragments. Mienis (1992a) had noticed that, *Calaxis* species were attracted to the fungus growing on decaying bones and were collected from a human skull at Khirbet Amirat (Israel). *Caracollina lenticula* is a small lentiform species found in the site. Its general distribution is circum-Mediterranean from the Cape Verde Islands to Palmyra. It is a relict of the Pleistocene and post-pluvial past, when the Mediterranean climatic zone extended further inland from the Levantine Coast (Schütt 1987). However, the activities of rodents (like the white-toothed shrew) and birds cannot be excluded; since predation on freshwater molluscs, like *Melanopsis* and land snails, like *Monacha*, by birds and rodents has been frequently noted (Mienis 1992b; 1996).

*Euchondrus* species have a large, discontinuous geographical distribution. They seem to be confined primarily to sandy areas in the coastal plains of Israel and

Egypt (Bar 1992). *E. spetementatus* was abundant in the destruction phases of Tell Jenin. This species could prevent or exclude other species like *E. sulcidens* or *E. ovularis* from inhabiting the site, since it has come down from the hills and occupied the “Qurqar” hills in the northern of Palestine.

*Xerocrassa* species are subterranean snails occurring in the drier parts of the deserts in Israel, like the coastal area of the Dead Sea, the Negev and the adjoining areas in Sinai. Many species of *Xerocrassa* were described in archeological sites of the Levant, and found in the destruction and abandonment phases the Late Bronze Age stratum of Tell Jenin (Ezzughayyar, Al-Zawahra, and Salem 1996).

*Melanopsis* species are abundant in the site; *M. buccinoidea* (fig. 17-2, B) is distributed all over the eastern Mediterranean region and Mesopotamian basin where there are several subspecies. *M. certhiopsis* is considered to be a relict of the *Melanopsis* inhabiting the Pliocene connection between Euphrates and Jordan Valley (Schütt 1987). *Melanopsis certhiopsis* is sympatric with *M. buccinoidea* in most of the streams and sources in the lower Jordan valley and Emeq Bet Shean, (except for the Jordan River, which is inhabited by *M. costata*), without showing any interbreeding (Mienis 1983).

Since the *Melanopsis* species of Tell Jenin were concentrated in the construction phase of the Late Bronze Age stratum, it is reasonable to conclude that these freshwater snails were brought within the mud from the river banks (Al-Muqatta' River) used for mudbrick manufacturing or building. The idea that freshwater shells were brought into the site with mudbricks was first suggested by Bar-Yosef and Heller (1987). This coincides with the observations of Ezzughayyar, Al-Zawahra, and Salem (1996). *Theodoxus (Neritaea) jordani* is a very abundant freshwater prosobranch in our flotation samples, especially in the construction phases of the site (fig. 17-2D). This species occurs mainly in flowing or turbulent water bodies, springs, rivers and lakes. *Theodoxus* is a suitable object for studies in paleozoo-geography of the Middle Eastern countries (Roth 1987). The faunal history of the genus *Theodoxus* suggests that its origin lies on the Eurasian plate, whereas the subgenus *Neritaea* originated from the northern part of the African plate, which in Jurassic times included the so-called Apulian microplate (Biju-Duval, Dercourt, and Le Pichon 1976). The distribution of *Theodoxus* populations could be explained by derivation from snails inhabiting brackish sections of the coastal belt of the Aegean and Marmara basins. In this way brackish water basins serve as pathway from regions at the former southern border of the Eurasian plate into regions of the Apulian plate (Roth 1987).

The presence of considerable number of hydrobiid snails in the site reflects the richness of brackish springs in the

area, since these very small snails inhabit fresh water springs and probably live in the stenothermic parts of the outflow of subterranean waters. So, it was reasonable to find these snails in the construction phases of Tell Jenin (mudbrick construction). The opercula that were found in the construction phases of the site were related to the hydrobiid species. *Levantina* and *Helix* species (fig. 17-3A & B, respectively) were the largest in size of the land snails recovered at this site, perhaps indicating that these species could be dietary items for the people of that time. The importance of these snails is related to their sensitivity to climatic conditions which is reflected in the dimensions of their shells. Bar-Yosef Mayer (2005b) had explained that climate and seasonality reconstructions are typically undertaken when studying middens. In many archaeological sites, land and freshwater snails are useful in reconstructing past environments.

The presence of marine shells (fig. 17-4) in the Late Bronze Age stratum supports the idea that shellfishing was practiced by the inhabitants of the site. Since shellfish perish very rapidly and have to be consumed shortly after gathering, most of shell debris would probably not be taken back to the habitation site (40 km from the Mediterranean shore), but rather consumed on the sea shore. This might explain the small quantity of edible shellfish in the site. It is not clear whether they were collected directly by the Tell inhabitants or by exchange with other groups who lived closer to the shores. Of more central importance to local diet were the domestic animals (sheep, goat and cattle) that were an important source of food and raw material in the Bronze Age economy of the southern Levant (Bar-Yosef Mayer 2005a; Horwitz and Tchernov 1989). Marine shells have been used for cultural purposes in the southern Levant since Paleolithic times (Bar-Yosef 1989; Reese 1991b).

The common Mediterranean marine bivalve *Glycymeris* was more abundant than other bivalves at the site. All specimens were perforated at umbo region (fig. 17-6B). These bivalves were perforated either naturally or by people for wearing as necklaces, since they are strong shells (Bar-Yosef Mayer, Vandermeersh, and Bar-Yosef 2009). Biggs (1963; 1969) suggested that *Glycymeris* symbolize the moon or the moon deity, while *Cardium (Cerastoderma)* with the ridges represent the sunrays (fig. 17-4A).

At Tell Ta'annek (10 km north of Tell Jenin), there is a sharp increase in number of perforated *Glycymeris* in the Bronze Age, which might indicate a rise in the use of shell beads as a social status symbols (Ezzughayyar and Al-Zawahra 1996). *Unio terminalis* was the only freshwater bivalve found at Tell Jenin (fig. 17-2A). The specimens were fragile and tend to break readily, which explain the large number of fragments. These bivalves might have been embedded in mud brought in for brick manufacture or building. The activities of rodents or birds should also

be considered (Mienis 1992a).  
The presence of Red Sea *Dentalium* species at Tell Jenin

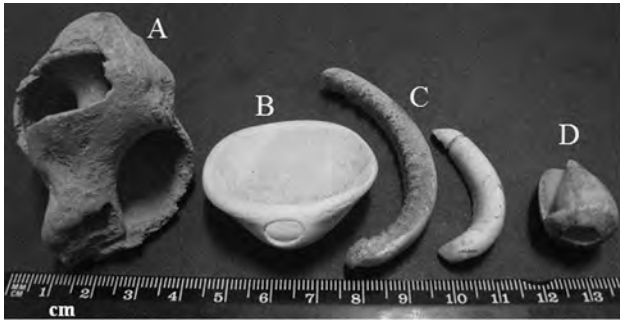


Figure 17-6. Modified shells. A: *Bolinus brandaris*;  
B: *Glycymeris violascens*; C: *Cassid lips*; D: *Conus mediterraneus*.

supports the idea that these shells were used as exchange items between southern and northern communities. The *Dentalium* specimens are found in burials decorating more males than females (Bar-Yosef Mayer 2005a; Belfer-Cohen 1988).

Muricid shells include the Mediterranean Basin gastropod *Bolinus brandaris* (fig. 17-4E), known for its association with purple dye production in Roman times. This ancient industry dates back to 1600-1500 BC in Northern Syria and Greece (Reese 1987). This is not the case of Tell Jenin, since thousands of *Murex* specimens would be needed to extract a small amount of dye (Spanier 1986).

The shells of *Nassarius* (fig. 17-4C) species have been used since the Neolithic by men and women as an expression of beauty or for some magical and ritual purposes (Bar-Yosef Mayer 2005a; Reese 1991a).

The lips of *Phalium* shells (fig. 17-6C) are known from a number of Near Eastern and Mediterranean archaeological sites; most of these lips can be seen as personal ornaments or offerings in graves or sanctuaries (Reese 1989).

*Conus mediterraneus* specimens found in the site had holes at the apical region, so we suggest their use as necklaces (fig. 17-6D). *Conus* shells with apical holes are found at a number of sites in Israel, including Beth Shan, Ain Shems and Megiddo (Bar-Yosef Mayer 2005a; Reese 1986).

It is customary to assume that naturally accumulated paleontological assemblages reflect the fauna that once existed in an area, whereas archaeological assemblages reflect human activities, which are not necessarily local, and therefore cannot be used for environmental reconstruction. However, if one can separate species that naturally accumulate at a site from those brought in by humans, then, one can use those species in environmental reconstruction and compare the conditions under which species exists today (Brewer 1992; Claassen 1991).

The Southern Levant exhibits remarkable spatial variability in climatic and vegetation zonation (Zohary 1981). This mosaic environment is clearly reflected by the regional faunal diversity (Tchernov 1979). The various groups of marine, freshwater, and terrestrial snails and their distribution represent changing ecological and environmental parameters thus shedding light on human social and economic activities within the Late Bronze period of Tell Jenin.

## Conclusions

The molluscan fauna of Tell Jenin accumulated in the Late Bronze Age stratum during the human occupation period of the site. The dominance of landsnails may reflect a very short human occupation or the desertion of the site. However, the dominance of the freshwater snails during the construction phase is thought to be due to their presence in the mud used for mudbrick building. The presence of marine shells in Tell Jenin supports the idea that collection of dead shells was familiar to the inhabitants of the site rather than shellfishing as an economic practice. The presence of perforated shells in the site indicates their use as beads or pendants. Finally, the small shell size of some annual molluscs, compared to present size of these molluscs, indicates less humid climatic conditions during the Late Bronze Age.

## Acknowledgements

We are very grateful to Dr. L. Glock from the Palestinian Institute of Archaeology for making the faunal material of Tell Jenin available. We also thank Mr. Ibrahim Iqtait for drawing fig. 17-1.

## References

- ABBOT, R.T. DANCE S.P. 1982. *Compendium of Seashells*. Dutton Inc, New York.
- ALBRIGHT, W.F. 1926. The topography of the tribe of Issachar. *Zeitschrift für die Alttestamentarische Wissenschaft* 44:225-236.
- BARASH, A. and Z. DANIN 1982. Mediterranean mollusca of Israel and Sinai: Composition and distribution. *Israel Journal of Zoology* 31:86-118.
- BAR, Z.M. 1992. The geographical distribution of *Euchondrus sulcidens* (Mousson, 1861). *Argamon* 13:1-8.
- BAR-YOSEF, D.E. 1989. Late Paleolithic and Neolithic marine shells in the Southern Levant as cultural markers. *Proceeding of the 1986 shell bead Conference* C.F. Hayes (ed.), Rochester Museum and Science Center, Research Records, 20:169-174.

- 17 - A. EZZUGHAYYAR ET AL. : ARCHAEOZOOLOGICAL ANALYSIS OF MOLLUSCAN FAUNA FROM THE LATE BRONZE AGE STRATUM OF SITE...
- . 1991. Changes in the selection of marine shells from the Natufian to the Neolithic. In: Bar-Yosef, O. & Valla, F.R. (eds.): *The Natufian Culture in the Levant*: 629-636. International Monographs in Prehistory. Ann Arbor, Michigan.
- BAR-YOSEF, D.E. and J. HELLER. 1987. Mollusca from Yiftahel lower Galilee, Israel. *Paleorient* 13:131-135.
- BAR-YOSEF MAYER, D.E. 2005a. The exploitation of shells as beads in the Paleolithic and Neolithic of the Levant. *Paleorient*. 31(1):176-185.
- . 2005b. Archaeomalacology: molluscs in former environments of human behavior. *Proceedings of the 9<sup>th</sup> Conference of the International Council of Archaeology, Durham, 2002*. Bar-Yosef, D.E. (Ed), Oxford Books, Oxford:132-147.
- . 2008. Invertebrate Analysis In: *Encyclopedia of Archaeology*, ed. by Deborah M. Pearsall. Academic Press, New York.
- BAR-YOSEF MAYER, D.E., B. VANDERMEERSH, and O. BAR-YOSEF. 2009. Shells and ochre in Middle Paleolithic Qafzah Cave, Israel: Indications for modern behavior. *Journal of Human Evolution* 56 (3):307-314.
- BELFER-COHEN, A. 1988. *The Natufian settlement at Hayonim Cave*. Unpublished Ph.D. thesis, The Hebrew University, Jerusalem.
- BIGGS, H.E.J. 1963. On the mollusca collected during the excavations at Jericho 1952-1958, and their archaeological significance. *Man* 153:125-128.
- . 1969. Molluscs from human habitation sites, and the problem of ethnological interpretation: In: Brothwell, D. & Higgs, E. (eds.): *Science in Archaeology*:423-427. Thames and Hudson, London.
- BIJU-DUVAL, B., J. DERCOURT, and X. LE PICHON. 1976. La genese de la Mediterranee. *La recherche* 71:811-822.
- BREWER, D.J. 1992. Zooarchaeology, method, theory and goals. *Archeological Method and Theory* 4:195-244.
- CLAASSEN, C. 1991. Normative thinking and shell-bearing sites. *Archaeological Method and Theory* 3:249-298.
- EZZUGHAYYAR, A. and M. AL-ZAWAHRA. 1996. Molluscan fauna from Tell Ta'annek (Northern West Bank-Palestine). *Archaeozoologia* VIII/1.2:71-88.
- EZZUGHAYYAR, A., M. AL-ZAWAHRA, and H. SALEM. 1996. Molluscan fauna from site 4 of Tell Jenin (northern West Bank-Palestine). *Journal of Archaeological Science* 23:1-6.
- GLOCK, A.E. 1979. Tell Jenin. *Revue Biblique* 86:110-112.
- . 1987. Tell Jenin excavations 1977-1983. *Birzeit Research Review* 4:4-30.
- GORING-MORRIS, A. N. 1989. Sociocultural aspects of marine mollusk use in the terminal Pleistocene in the Negev and Sinai regions of the Southern Levant. In *Proceeding of the 1986 Shell Bead Conference*, C.F. Hayes (Ed), Rochester Museum and Science center, *Research Records*, 20:175-187.
- HELLER, J. and E. TCHERNOV. 1978. Pleistocene land snails from coastal plain of Israel. *Israel Journal of Zoology* 27:11-19.
- HELLER, J. 1993. *Land snails of the land of Israel: Natural history and a field guide*. The Ministry of Defense, Israel. 271pp.
- HORWITZ L.K. and E. TCHERNOV. 1989. Animal exploitation in the Early Bronze Ages of the Southern Levant, in: *L'urbanisation de la Palestine à l'age du Bronze ancien*. P.D. Miroscedji (Ed.). Oxford, BAR International Series, 527:279-296.
- MIENIS, H.K. 1982. A checklist of the land molluscs of Israel and the Administered Areas. *Levantina* 39:457-465.
- MIENIS, H.K. 1983. A preliminary checklist of freshwater molluscs of Israel and the Administered Areas. *Levantina* 47:543-450.
- .1986a. A revised checklist of the brackish and freshwater molluscs from Israel and the Administered Areas. *Levantina* 63:675-682.
- .1986b. Notes on molluscs from Cyprus: A brief note concerning the family Pyramidulidae. *Levantina* 62:673-674.
- .1992a. Land snails in a human skull from Khirbet Amarit, Israel. *The Papustyla* 6(4):46.
- .1992b. Additional notes concerning predation on landsnails by white-toothed shrews in Israel. *Malacological Newsletters* 11:47-50.
- .1996. Selective predation on *Monacha haifaensis* (Mollusca: Gastropoda) by *Crocidura suaveolens* (Mammalia: Insectivora). *Nachrichtenblatt der Ersten Vorarlberger Malakologischen Gesellschaft* 4:43-46.

## ARCHAEOMALACOLOGY : SHELLS IN THE ARCHAEOLOGICAL RECORD

- REESE, D.S. 1986. *The marine and freshwater shells, in: The Late Bronze and Iron Ages of Central Transjordan: The Baq'ah valley project, 1977-1981* P. Mc Govern (ed.), Monograph 65 Philadelphia, The University Museum XIII:320-332
- . 1987. The Mediterranean shell purple-dye industry. *American Journal of Archaeology* 90(2):183.
- . 1989. On Cassid lips and Helmet shells. *Bulletin of the American Schools of Oriental Research* 257:33-39.
- . 1991a. The trade of Indo-Pacific shells into the Mediterranean Basin and Europe. *Oxford Journal of Archaeology* 10(2):159-196.
- . 1991b. Marine shells in the Levant: upper Paleolithic, Epipaleolithic and Neolithic, in: *The Natufian Culture in the Levant*, O. Baryosef and F.R. Valla (Eds), International Monographs in Prehistory, Ann Arbor Archaeological Series 1, 613-628
- ROTH, J.R. 1987. Data on the distribution and faunal history of the Genus *Theodoxus* in the Middle East (Gastropoda: Neritidae). In: F. Krupp, W. Schneider & R. Kinzelbach (eds.). *Proceedings of the Symposium on the Fauna and Zoogeography of the Middle East Mainz 1985*. Wiesbaden. Beihefte zum TAVO. A 28, 73-79.
- SCHÜTT, H. 1983. Die Molluskenfauna der SuBwasser in Einzugsgebiet des Orontes unter Berücksichtigung benachbarter Flußsysteme. *Archiv für Mollusken funde* 113: Pp 17- 91, 225-228.
- SCHÜTT, H. 1987. The Molluscs of the Oasis Palmyra. In: F. Krupp, W. Schneider and R. Kinzelbach (eds.), *Proceedings of the Symposium on the Fauna and Zoogeography of the Middle East, Mainz 1985*. Wiesbaden. Beihefte zum TABO, A 29. Pp 62-72.
- SHARABATI, D. 1984. *Red Sea Shells*. KPI, London, Boston, Melbourne, Hentey, 128 pp.
- SPANIER, E. 1986. Cannibalism in Muricid snails as a possible explanation for archaeological findings. *Journal of Archaeological Science* 13:463-468.
- TCHERNOV, E. 1979. Quaternary Fauna. In: A. Horowitz (Ed.). *The Quaternary of Israel*. New York, Academic Press. Pp 259-290.
- TORNARITIS, G. 1987. *Mediterranean Sea shells*, Nicosia, G. Tornaritis, 190 pp.
- VÖLMAN, T.P. 1978. Early archaeological evidence for shellfish collecting, *Science* 201:911-913.
- ZOHARY, M. 1981. On the flora and vegetation of Middle East structure and evolution. In: W. Frey & H.-P. Uerpman (eds.), *Beiträge zur Umweltgeschichte des vorderen orientes*. Wiesbaden. Ludwig Reichert. Pp. 1-25.