New Approaches to Old Stones
Approaches to Anthropological Archaeology

Series Editor: Thomas E. Levy, University of California, San Diego

Editorial Board:
Guillermo Algaze, University of California, San Diego
Geoffrey E. Braswell (University of California, San Diego)
Paul S. Goldstein, University of California, San Diego
Joyce Marcus, University of Michigan

This series recognizes the fundamental role that anthropology now plays in archaeology and also integrates the strengths of various research paradigms that characterize archaeology on the world scene today. Some of these different approaches include ‘New’ or ‘Processual’ archaeology, ‘Post-Processual’, evolutionist, cognitive, symbolic, Marxist, and historical archaeologies. Anthropological archaeology accomplishes its goals by taking into account the cultural and, when possible, historical context of the material remains being studied. This involves the development of models concerning the formative role of cognition, symbolism, and ideology in human societies to explain the more material and economic dimensions of human culture that are the natural purview of archaeological data. It also involves an understanding of the cultural ecology of the societies being studied, and of the limitations and opportunities that the environment (both natural and cultural) imposes on the evolution or devolution of human societies. Based on the assumption that cultures never develop in isolation, Anthropological Archaeology takes a regional approach to tackling fundamental issues concerning past cultural evolution anywhere in the world.

Published:
Archaeology, Anthropology and Cult
The Sanctuary at Gilat, Israel
Edited by Thomas E. Levy

Connectivity in Antiquity
Globalization as a Long Term Historical Process
Edited by Øystein LaBianca and Sandra Arnold Scham

Israel’s Ethnogenesis
Settlement, Interaction, Expansion and Resistance
Avraham Faust

Axe Age
Acheulian Tool-making from Quarry to Discard
Edited by Naama Goren-Inbar and Gonen Sharon

Forthcoming:
Prehistoric Societies on the Northern Frontiers of China
Archaeological Perspectives on Identity Formation and Economic Change during the First Millennium BCE
Gideon Shelach

Metal, Nomads and Cultural Contact
The Middle East and North Africa
Nils Anfinset

Dawn of the Metal Age
Jonathan Golden

Structured Worlds
The Archaeology of Hunter-Gatherer Thought and Action
Edited by Aubrey Cannon

Desert Chiefdom
Dimensions of Subterranean Settlement and Society in Israel’s Negev Desert (c. 4500–3600 BC) Based on New Data from Shiqmim
Edited by Thomas E. Levy, Yorke M. Rowan and Margie M. Burton

Ultimate Devotion
The Historical Impact and Archaeological Reflections of Religious Extremism
Yoav Arbel

Animal Husbandry in Ancient Israel – A Zoo-archaeological Perspective
Herd Management, Economic Strategies and Animal Exploitation
Aharon Sassoon
New Approaches to Old Stones

Recent Studies of Ground Stone Artifacts

edited by

Yorke M. Rowan and Jennie R. Ebeling
Contents

List of Contributors viii
List of Figures xi
List of Tables xv

1 Introduction: The Potential of Ground Stone Studies
Yorke M. Rowan and Jennie R. Ebeling 1

I. PRODUCTION AND EXCHANGE

2 Geological Constraints on Ground Stone Production and Consumption in the Southern Levant
Joan S. Schneider and Philip C. LaPorta 19

3 Discovery of a Medieval Islamic Industry for Steatite Cooking Vessels in Egypt’s Eastern Desert
James A. Harrell and V. Max Brown 41

4 Beyond the Mohs Scale: Raw Material Choice and the Production of Stone Vases in a Late Minoan Context
Tristan Carter 66

5 Stones on Stone: Assessing the Use of Handstones as Tools to Process Stone Artifacts at PPNB Ba’ja in Southern Jordan
Philipp M. Rassmann 82

6 A Chip Off the Old Millstone: Grinding Stone Production and Distribution in the Early Bronze Age of the Negev
Yael Abadi-Reiss and Steven A. Rosen 99
7 The Exchange of Ground Stone Tools and Vessels during the Early Bronze Age in the Southern Levant
Ianir Milevski 116

8 Craft Production and the Organization of Ground Stone Technologies
Katherine I. Wright 130

9 Maize-Grinding Tools in Prehispanic Central Mexico
Martin Biskowski 144

II. INTERPRETING FUNCTION, PRIMARY VS. SECONDARY USE

10 Grinding Stones and Seeds of Change: Starch and Phytoliths as Evidence of Plant Food Processing
Richard Fullagar, Judith Field and Lisa Kealhofer 159

11 Identifying Lightly Used Polishing Stones: Experiments and Implications
Martha Trenna Valado 173

12 Wear Patterns on Ground Stone Implements from Tel Yin’am
Harold A. Liebowitz 182

13 Variation in the Organization of Prehistoric Milling Technologies of the Northern Mojave Desert, North America
Mark E. Basgall 196

14 Beyond the Broken
Jenny L. Adams 213

Seiji Kadowaki 230

16 The Changing Face of Ground Stone Studies in the American Great Basin
Renee Corona Kolvet 258
III. SYMBOLS OF LUXURY AND RITUAL EQUIPMENT

17 Basalt Bowls in Early Bronze IA Shaft Tombs at Bab edh-Dhra’: Production, Placement and Symbolism
   R. Thomas Schaub 277

18 Stone Alabastra in Western Anatolia
   C.H. Roosevelt 285

19 Carving Luxury: Late Classic White Stone Vase Traditions in Mesoamerica
   Christina Luke 298

20 Stone Vessel Production Caves on the Eastern Slope of Mount Scopus, Jerusalem
   David Amit, Jon Seligman and Irina Zilberbod 320

21 Beyond Provenance Analysis: The Movement of Basaltic Artefacts through a Social Landscape
   Graham Rutter and Graham Philip 343

IV. NEW INSIGHTS FROM OLD STONES

22 New Insights from Old Stones: A Survey of Ground Stone Studies
   Jane Peterson 361

Index 371
List of Contributors

Yael Abadi-Reiss is a Kreitman doctoral fellow and student in the Archaeological Division at Ben-Gurion University, working on the Qatifian culture of the northern Negev. She has extensive field experience with the Israel Antiquities Authority and has directed excavations at the Chalcolithic site of Tel Sheva. Email: abadi@bgu.ac.il

Jenny L. Adams PhD is Research Archaeologist at Desert Archaeology, Inc., in Tucson, Arizona. Email: jadams@desert.com

Dr David Amit is a senior archaeologist at the Israel Antiquities Authority. Email: amit@israntique.org.il

Mark Basgall has been involved with archaeological research in California and the western Great Basin for three decades. He is currently a professor in the Department of Anthropology, California State University, Sacramento, where he also serves as director of the Archaeological Research Center. Email: mbasgall@csus.edu

Martin Biskowski is an assistant professor in the Department of Anthropology at California State University, Sacramento. He is a ground stone tool specialist who works with several projects at Teotihuacan and elsewhere in Central Mexico. Email: biskowsk@csus.edu

V. Max Brown is an associate professor of Geology at the University of Toledo and specializes in the petrology of igneous and metamorphic rocks. Email: vernon.brown@utoledo.edu

Tristan Carter is an assistant professor of Anthropology at McMaster University. He specializes in East Mediterranean lithic technology, particularly the southern Aegean and Çatalhöyük in Central Anatolia. His other research interests include obsidian sourcing, Y-chromosome human genetic analysis and the archaeology of the body. Email: stringy@mcmaster.ca

Jennie R. Ebeling is an assistant professor of Archaeology in the Department of Archaeology and Art History at the University of Evansville. She specializes in ground stone tools from the Bronze and Iron Ages in the southern Levant. Email: je55@evansville.edu

Judith Field is a senior research associate at the University of Sydney, undertaking research into the archaeology of megafaunal extinctions and the human occupation of rainforest environments in Australia. She also has an interest in residue studies on flaked and ground stone tools. Email: j.field@usyd.edu.au

Richard Fullagar is an honorary associate with the Department of Archaeology, School of Philosophical and Historical Inquiry, University of Sydney, a research associate of the Australian
Museum, and a director of Scarp Archaeology, which undertakes cultural heritage projects and stone artefact research. Email: richard.fullagar@scarp.com.au

James A. Harrell is a professor of geology at the University of Toledo and has been conducting geoarchaeological research in Egypt since 1989. Email: james.harrell@utoledo.edu

Seiji Kadowaki is a Social Sciences and Humanities Research Council of Canada postdoctoral fellow at the University of Tokyo and project member of the investigations at Ayn Abu Nukhayla, southern Jordan, and in Wadi Ziqlab, northern Jordan. Email: s_kadowaki@hotmail.com

Lisa Kealhofer, associate professor at Santa Clara University, is currently co-directing a ceramic archaeometric project for Iron Age western Turkey. Email: lkealhofer@scu.edu

Renee Corona Kolvet is an archaeologist with the US Bureau of Reclamation (under the Department of Interior), Lower Colorado Regional Office in Boulder City, Nevada. She has studied the technological and ideological implications of ground stone assemblages in the Old World (Jordan and Cyprus) and the American West for the past 15 years. Email: rfcorona@aol.com

Philip C. LaPorta is a geologist specializing in sedimentary rocks. He has special research interests in the anthropology of quarrying and mining and is president of LaPorta and Associates in New York and Pennsylvania, a geological consulting company. Email: plaporta@laportageol.com

Harold A. Liebowitz, professor of Middle Eastern Studies at the University of Texas at Austin, specializes in the archaeology and art history of the ancient Near East, with particular emphasis on the Late Bronze to Mamluk periods in Israel, Jordan and Syria, and has directed excavations at Tel Yin’am and Khirbet Beit Gan on behalf of the university. Email: liebowitz@mail.utexas.edu

Christina Luke teaches in the Writing Program at Boston University and co-directs cultural heritage programs for the University of Pennsylvania Museum of Anthropology and Archaeology. Her research focuses on the development of social complexity in the regions of Mesoamerica and western Turkey. Email: cluke@bu.edu

Dr Ianir Milevski is research archaeologist at the Israel Antiquities Authority and post-doctoral fellow at the W.F. Albright Institute of Archaeological Research, Jerusalem. Email: ianir@israntique.org.il

Jane Peterson is an associate professor at Marquette University and director of the Khirbet Hammam Archaeological Project in Jordan. Email: jane.peterson@marquette.edu

Graham Philip holds a chair in Archaeology at Durham University and currently co-directs the Syrian-British regional project Settlement and Landscape Development in the Homs Region. Email: graham.philip@durham.ac.uk

Philipp M. Rassmann is a PhD candidate at the University of Washington and the ground stone tool specialist at Domuztepe, a Pottery Neolithic site in SE Turkey. Email: rassp@u.washington.edu

Christopher H. Roosevelt (PhD 2003, Cornell University) is an assistant professor in the Department of Archaeology at Boston University. His research focuses on the archaeology of western Anatolia, specifically the ancient region of Lydia, the hinterland of Sardis, and he is director of the Central Lydia Archaeological Survey. Email: chr@bu.edu
Steve A. Rosen is a professor of archaeology at Ben-Gurion University. He is currently the director of the Humphrey Institute for Social Research and the editor of the Journal of the Israel Prehistory Society. His research focuses on stone tool analysis and desert archaeology. Email: rosen@bgu.ac.il (or) sarosen@gmail.com

Yorke M. Rowan is a research associate with the Department of Anthropology, National Museum of Natural History, Smithsonian Institution. He specializes in prehistoric lithic technologies of the southern Levant; his other research interests include mortuary and ritual practices. Email: rowany@si.edu

Graham Rutter is currently training to be an ordained Anglican minister at St John’s College, Nottingham. Email: graham_rutter@yahoo.co.uk

R. Thomas Schaub is professor emeritus, Indiana University of Pennsylvania and co-director, Expedition to the Dead Sea Plains. Email: rtschaub@verizon.net

Joan S. Schneider (PhD 1993 University of California, Riverside) is a California State Parks associate state archaeologist in the Colorado Desert District. She is currently conducting research on basalt sources for milling stones and vessels in northern Israel. Email: jschneider@parks.ca.gov

Jon Seligman is the Jerusalem Regional Archaeologist for the Israel Antiquities Authority. Email: jon@israntique.org.il

Martha Trenna Valado recently received a doctorate in anthropology from the University of Arizona, where her archaeological research focused on ground stone technology in the US Southwest. Email: mtvalado@gmail.com

Katherine I. Wright is lecturer in Archaeology of the Levant at the Institute of Archaeology, University College London. She is involved in the study of ground stone technologies at a number of sites across the Middle East. Email: k.wright@ucl.ac.uk

Irina Zilberbod is an archaeologist at the Israel Antiquities Authority. Email: irinazil@israntique.org.il
PART I

2.1 Quarry fronts at the crest of Antelope Hill.
2.2 Large blocks ready for extraction at Antelope Hill.
2.3 One quarry front at Antelope Hill.
2.4 An archaeological crew works on the top of a quarry front at Antelope Hill.
2.5 Quarried outcrop at the crest of one of the Palo Verde Quarry District milling-implement quarries.
2.6 A fine-grained granite dyke within quartz-monzonite bedrock.
2.7 Cache of quartzite river-cobble hammerstones at the Polodori Quarry.
2.8 A production locus at the Ironwood Quarry in California.
2.9 Very large cobble hammerstone found at Antelope Hill.
2.10 A pic-shaped hammerstone.
2.11 Experimental use of tule watercraft.

3.1 Map of Egypt showing the localities mentioned in the text.
3.2 Excavation pits in the Gebel Rod el-Baram steatite quarry.
3.3 Mattock marks in the Wadi Abu Qureyah steatite quarry.
3.4 Site within the Wadi Kamoyib steatite quarry where a vessel blank was cut directly from the excavation wall.
3.5 Excavation channel in the Wadi Mubarak steatite quarry.
3.6 Wedge and pick marks in the Wadi Mubarak steatite quarry.
3.7 Vessel workshop in the Gebel Rod el-Baram steatite quarry.
3.8 Example of a fully roughed-out and unbroken vessel from near the Wadi Umm Selim steatite quarry.
3.9 Example of a fully roughed-out but broken vessel in the Gebel Rod el-Baram steatite quarry.
3.10 Steatite vessel morphology chart.
3.11 Partially roughed out vessel of the deep-pot type without lug handles in the Wadi Mubarak steatite quarry.
3.12 Partially roughed-out vessel of the shallow-platter type without lug handles in the Wadi Mubarak steatite quarry.
3.13 Partially roughed-out vessel of the deep-pot type with lug handles in the Gebel Rod el-Baram steatite quarry.
3.14 Partially roughed-out vessel of the shallow-platter type with lug handles in the Gebel Rod el-Baram steatite quarry.
3.15 Partially roughed-out vessel with four lug handles in the Gebel Rod el-Baram steatite quarry.
3.16 Partially roughed-out lid for a vessel in the Gebel Rod el-Baram steatite quarry.
3.17 Partially roughed-out incense burners in the Gebel Rod el-Baram steatite quarry.
3.18 Steatite cooking vessel used by an Ababdah Bedouin family.

4.1 Map of Crete showing sites mentioned in the text.
4.2 Green amphibolite drill-guides and sub-cuboid grinders from Late Minoan I Mochlos.
4.3 Selection of green amphibolite drill-guides from Late Minoan I Mochlos.
NEW APPROACHES TO OLD STONES

4.4 Plan of the Mochlos Island excavations indicating contexts mentioned in the text.
4.5 Plan of the Mochlos Artisans’ Quarters.

5.1 Location of Ba’ja in Southern Jordan.
5.2 Variability in length:width ratios of Ba’ja 1997 ground stone handstones from Area C.
5.3 Variability in length:thickness ratios of Ba’ja 1997 ground stone handstone from Area C.
5.4 Variability in width:thickness ratios of Ba’ja 1997 ground stone handstones from Area C.
5.5 Frequency of length dimensions for Ba’ja 1997 ground stone handstones from Area C.
5.6 Frequency of width dimensions for Ba’ja 1997 ground stone handstones from Area C.
5.7 Frequency of thickness dimensions for Ba’ja 1997 ground stone handstones from Area C.
5.8 Active surface frequency for Ba’ja 1997 ground stone handstones from Area C.
5.9 Surface modification frequency for Ba’ja 1997 ground stone handstones from Area C.
5.10 Active surface frequency for Ba’ja 1999 ground stone handstones from Area D.
5.11 Surface modification frequency for Ba’ja 1999 ground stone handstones from Area D.

6.1 Map of region with sites mentioned in the text.
6.2 Flakes from Ramat Saharonim North.
6.3 Primary flake from Ramat Saharonim North. Note unmodified dorsal surface and flat ventral surface.
6.4 Rough-outs.
6.5 Lower milling stone, either unused or little used, from the Camel Site.
6.6 Plan of Ramat Saharonim North, showing location of outcrops and collection areas.
6.7 Tabular scraper fragment on the surface at Ramat Saharonim North, near Area C.
6.8 Comparison of waste frequencies from Ramat Saharonim North, the Camel Site, and Rekhes Nafha 396.
6.9 Weight distribution of waste according to length categories from Ramat Saharonim North, the Camel Site, and Rekhes Nafha.
6.10 Waste frequencies from Ramat Saharonim North, the Camel Site, and Rekhes Nafha 396 according to length classes.
6.11 Length distribution of flakes from Ramat Saharonim North, the Camel Site, and Rekhes Nafha 396.

7.1 Distribution of basalt objects and sources: Early Bronze Age I.
7.2 Distribution of sandstone, beachrock, and kurkar sources and objects: Early Bronze Ages I–III.

8.1 Map showing location of Neolithic sites discussed in the text. Drawing by K. Wright.
8.2 Grinding slabs made from local materials, Beidha, southern Jordan, Pre-Pottery Neolithic B.
8.3 Handstones made of local materials, Beidha, Pre-Pottery Neolithic B.
8.4 Pestles and ‘mullers’ made of non-local basalt, Beidha, Pre-Pottery Neolithic B.
8.5 Ground stone artifacts (all basalt) from Jilat 7, eastern Jordan.
8.6 Pendants made of ‘Dabba marble’—green apatitic limestone, Jilat 13, eastern Jordan, beginning of Late Neolithic (cf. Pre-Pottery Neolithic C).
8.7 Limestone worktable associated with large quantities of beadmaking debris, Jilat 13, beginning of Late Neolithic (cf. Pre-Pottery Neolithic C).
8.8 Limestone worktable associated with large quantities of beadmaking debris, Jilat 13, beginning of Late Neolithic (cf. Pre-Pottery Neolithic C).
8.9 Ground stone artifacts associated with large quantities of beadmaking debris, Jilat 25, beginning of Late Neolithic (cf. Pre-Pottery Neolithic C).

9.1 Flowchart of traditional tortilla production.
9.2 Ratio of transport costs to production costs.
PART II

10.1 The location of Cuddie Springs in southeastern Australia.
10.2 A. The broken grinding stone (including fragment CS6023) from Cuddie Springs recovered from archaeological horizons dated to c. 27 ka.
   B. Use-wear on the used surface of grindstone CS6023 typical of highly siliceous plant working.
10.3 Box plots for measurement of maximum dimension through the hilum of starch granules for some key economic plants from the arid/semi-arid zone.
10.4 Starch granules of some key economic plant species for the Australian semi-arid/arid zone.
10.5 Micrographs of starch granules (and phytoliths) from the surface of the grindstone CS6023 from Cuddie Springs.
10.6 Phytoliths identified in the residue extraction from Cuddie Springs grindstone CS6023.

11.1 Map of study area.
11.2 Sample microscopic photograph.

12.1 Two halves of Late Bronze Age grinding slab (AN 111418).
12.2 Late Bronze Age handstone (AN111386).
12.3 Two in situ lower grinding slabs in the Late Bronze Age courtyard of Building 1, facing south.
12.4 Late Bronze Age grinding slab and handstone.
12.5 Miller in Xiquinjuyo, Guatemala placing grains of corn in the middle of the metate.
12.6 Tortilla maker at Carapan, Michoacan, Mexico.

14.1 Map of site locations.
14.2 Line drawing of whole cruciform recovered from Los Pozos and manufactured from a clear quartz crystal.
14.3 Intentionally broken cruciform tines recovered from Las Capas.
14.4 Line drawing of a palette intentionally snapped into three pieces and recovered from Julian Wash.
14.5 Pipes broken during manufacture recovered from Las Capas.
14.6 Complete stone pipes with bone stems recovered from Las Capas.
14.7 Basin metate ‘killed’ by a manufactured hole, recovered from Los Pozos.

15.1 Map of the southern Levant showing Pre-Pottery Neolithic B sites mentioned in the text.
15.2 Building plan map at Block I at Ayn Abū Nukhayla (after Henry et al. 2003).
15.3 Building plan map at Block II at Ayn Abū Nukhayla (after Henry et al. 2003).
15.4 Stratigraphical diagrams of house-deposits at Ayn Abū Nukhayla.
15.5 Horizontal distribution of refuse at Locus 2 in Ayn Abū Nukhayla.
15.6 Horizontal distribution of refuse at Locus 5 in Ayn Abū Nukhayla.
15.7 Horizontal distribution of refuse at Locus 5 in Ayn Abū Nukhayla (continued).
15.8 Horizontal distribution of refuse at Locus 20 in Ayn Abū Nukhayla.
15.9 Horizontal distribution of refuse at Locus 22 in Ayn Abū Nukhayla.
15.10 Horizontal distribution of refuse at Locus 22 in Ayn Abū Nukhayla (continued).
15.11 Horizontal distribution of refuse at Locus 25 in Ayn Abū Nukhayla.
15.12 Horizontal distribution of rubble in Block I (left) and Block II (right) at Ayn Abū Nukhayla (after Henry et al. 2001).
15.13 Household units and the use of internal spaces inferred from floor assemblages.

16.1 Map of the hydrographic Great Basin.
16.2 Rock art decorates the walls of residential site 26WA2850.
16.3 A grinding slick atop of boulders at 26WA2850.
16.4 Petroglyphs with superimposed grinding have been linked with shamans’ rituals; however, glyphs at site 26WA1612 (pictured) are located in a residential complex.
16.5 Detail of ground stone distribution at Site 26WA267.
16.6 Bedrock mortar site near Carson City, Nevada.
16.7 Broken grinding stone re-made into a shaft straightener (Site 26WA267). (Photo: R. Corona Kolvet).
16.8 A hearth at site 26DO439 lined with small rocks and recycled grinding stone fragments. The slabs on floor acted as heat sinks for cooking and also radiated warmth.

Part III

17.1 Line drawing (a) and photo (b) of basalt bowl (Reg. # 696) from Tomb A 91, Bab edh-Dhra’.
17.2 Line drawing (a) and photo (b) of ceramic imitation of a basalt bowl (Reg. #582) from Tomb A 86SE, Bab edh-Dhra’.

18.1 Map of western Anatolia showing regions and sites mentioned in the text.
18.2 Variant shapes of stone alabastra from the Demira tumulus, Lydia.

19.1 Map showing major sites.
19.2 Ulúa-style marble vases, gold figure and jade hand from Santa Ana.
19.3 Maya-style alabaster vase, Kerr Vas K7749.
19.4 Maya-style alabaster vase, DO 2B-147-MAS.
19.5 Façade of the tomb of Ukit Kan Le’k Tok’, main acropolis, Ek Balam.
19.6 White-stone vase from tomb of Ukit Kan Le’k Tok’, Ek Balam.
19.7 White-stone vase from Gran Pyramid, Uxmal.
19.8 Jaguar Throne, Governor’s Plaza, Uxmal.

20.1 Location map of caves.
20.2 General view of cave exterior.
20.3 Plan and section of caves.
20.4 Production hall 1.
20.5 (A) Adze; (B) Wedge.
20.6 Measuring cups and large bowl damaged during production.
20.7 Lathe-turned vessels.
20.8 Cores of various sizes from lathe-turned vessels.
20.9 Spikes and plugs from large vessel lathe.
20.10 Reconstruction of large vessel lathe.
20.11 Reconstruction of small vessel lathe.
20.12 Bowls.
20.13 Cups and goblets.
20.14 Stoppers, cores, lids and large lathe-turned vessels.
20.15 Hand-carved mugs and pitchers.
20.16 Hand-carved large bowls and ossuary.

21.1 Identification to source of the Chalcolithic and Early Bronze I artifacts analysed using ICP-MS.
21.2 Identification to source of the Late Bronze Age and Iron Age artifacts analysed using ICP-MS.
21.3 Map showing the location of basaltic-rock outcrops in the southern Levant.
21.4 Actions affecting an artifact.
21.5 Actions, choices and constraints affecting a basaltic-rock artifact.
21.6 The total alkali-silica diagram.
List of Tables

PART I

Table 3.1 Egyptian quarries for steatite vessels.
Table 6.1 Sandstone lithic distribution from the Camel Site.
Table 6.2 Size distribution of sandstone artifact types from the Camel Site.
Table 6.3 Sandstone lithic type distribution from Rekhes Nafha 396.
Table 6.4 Sandstone artifact distribution from Ramat Saharonim North by area.
Table 6.5 Grinding stone dimensions, Area C Ramat Saharonim North.
Table 7.1 Distribution of basalt objects from Early Bronze Age II and I sites according to sources.
Table 7.2 Distribution of beach-rock, kurkar and ferruginous sandstone artifacts from Early Bronze Age sites.
Table 9.1 Mass/Length ratios of mano fragments with lengths >50 mm.
Table 9.2 Base costs for craft items in kilograms of maize.
Table 9.3 Base costs for craft per family per year in kilograms of maize.
Table 9.4 Base grinding tool costs per year in maize-kilograms as a function of distance.
Table 9.5 Fuel expenditures associated with various foods.

PART II

Table 11.1 Recipes for clay mixtures used in the experiments.
Table 11.2 Number of used surfaces on pottery polishing stones by site.
Table 11.3 Intensity of pottery polishing stone use by site.
Table 13.1 Select compositional summary for the Fort Irwin locality.
Table 13.2 Grinding stone and handstone attributes by class.
Table 13.3 Grinding stone attributes by temporal period.
Table 13.4 Handstone attributes by temporal period.
Table 14.1 Condition and contexts of ground stone artifacts.
Table 15.1 Inventory of ground stone tools from Ayn Abū Nukhayla.
Table 15.2 Life histories of residential buildings as indicated by the sequences of depositional phases in house-deposits at Ayn Abū Nukhayla.
Table 15.3 Comparison of the density and diversity of ground stone tools between activity areas at floor phases and reoccupational phases.
Table 15.4 Ground stone tool types recovered from reoccupational phases.
PART III

Table 18.1  *Alabastra* and tomb types in sixth–fourth century Lydia.

Table 19.1  Distribution of white stone vases with known provenience by site.

Table 20.1  Lathe-turned chalk bowls.
Table 20.2  Lathe-turned cups and goblets.
Table 20.3  Stoppers, lids, cores and lathe-turned kraters.
Table 20.4  Hand-carved mugs (‘measuring cups’).
Table 20.5  Hand-carved bowls (quasi ‘measuring cups’) and basins.

Table 21.1  Physical properties.
Introduction: The Potential of Ground Stone Studies

Yorke M. Rowan and Jennie R. Ebeling

Why Study Ground Stone?

Archaeology is unique among the social sciences because it requires that we study all material remains—from unique works of art to common household tools—to better understand past human behavior, particularly the basic subsistence activities that occupied the lives of most ancient people. Researchers have created sophisticated technical and typological approaches to the analyses of certain categories of material culture, particularly pottery and flaked stone; however, not all material culture receives equal attention, and in many areas of the world, selective reporting from the field limits the potential of any artifact class. Ground stone artifacts, long recognized as part of the essential domestic tool kit for food processing as well as other activities, are the most visible artifacts that provide information about a number of daily activities necessary for human survival. With notable exceptions, these artifacts have received only sporadic methodical attention in the archaeological community until recently. Whether researchers are interested in hunter-gatherers or food producers, ground stone artifacts are frequently a key component to understanding such diverse phenomena as subsistence patterns, sexual division of labor, social organization of craft production, and activities related to cultic and mortuary practices in past societies. These and other issues are investigated by the authors of the chapters in this volume, which is one of the first to bring together studies of ground stone artifacts from diverse sites and regions in order to demonstrate how this often overlooked class of material culture can be used to address a variety of research questions (but see Procopiou and Treuil 2002). Our intent is also to introduce archaeologists working around the world to the rich possibilities of ground stone studies, and promote awareness of the analytical potential of these tools. It is our hope that archaeologists would then treat excavated ground stone tools with the same analytical attention as other categories of material culture, which would allow for greater strides in ground stone research in the future.

What is Ground Stone?

As many scholars have noted, the phrase ‘ground stone’ when used to describe artifacts such as those collected in the studies of this volume is a broad, general term that does not always accurately
reflect the expansive category of material culture (Adams 2002:1; Runnels 1981:218; Schneider 1993:5; Wright 1991:4). The broad assumption underpinning the term ground stone requires two observations about the general class of artifacts. First, many artifacts in this category are made using a variety of techniques that include flaking, pounding, abrading, polishing, pecking and drilling. Traditional categorical distinctions between flaked and ground stone artifact classes do not reflect the common inference that many ground stone tools are initially flaked from a larger nodule or boulder and subsequently shaped using a variety of techniques, while some chipped stone artifacts involve platform grinding for effective flaking or grinding to complete the final tool. At the same time, some tools produced primarily through flaking may be ground, whether intentionally, or unintentionally, through use (Crabtree 1974). Second, ground stone can refer to the way a tool was used. Indeed, many classes of artifacts may be used as grinding equipment, but others are manufactured using similar techniques and produce artifacts that have little or nothing to do with reducing plant or other materials. Such objects include vessels, digging stick weights, axes, spindle whorls, hoes, etc.

For these reasons, definitional boundaries of such a study are problematic and ground stone is probably a less cohesive category than other common classes of material culture. Ground stone artifacts are generally thought of as utilitarian tools such as grinding slabs, handstones, mortars, and pestles, but they also include a multitude of poorly defined and amorphous groupings of artifacts. In addition, a number of object types that fall into this category were considered luxury items intended for elite classes and royalty, not quotidian subsistence tools for the reduction of grains and other substances. Perhaps the definition of such a category could be narrowly defined as those tools in the grinding process for the reduction of materials, commonly grains but including other substances such as salt, meat, bone, shell, pottery, pigments, ore and other materials (Cushing 1920; Hayden 1987; Kraybill 1977; Woodbury 1954). Clearly there is a continuum from the most basic forms of stone used for processing materials to those primarily used to hold precious liquids, for display, or for ritual purposes. For the present volume, we have chosen the broader, more inclusive perspective. Material culture classes such as building stone, decorative items, statuary and semi-precious stone were excluded as best reserved for other specific studies.

**Neglect of Ground Stone in Site Reports**

Studies of ground stone would, at first glance, appear to be simply one more component of material culture, much like chipped stone or pottery. However, as a number of authors in this volume note, ground stone studies more frequently fall under the category of ‘other’ in site reports, outside the main material culture categories of ceramics and chipped stone (Schneider 1993). In many regions, such studies are frequently limited to a short descriptive chapter or an appendix, rarely integrated into the synthetic understanding of a site. Similar situations are noted in Mesoamerica, the Aegean and the Near East.

There are a number of reasons for this neglect of ground stone assemblages in different parts of the world. The commonly observed slow change in basic grinding implements such as grinding slabs and handstones means that their potential as chronological indicators is much less than that of ceramics or flint projectile points. In some areas where ceramic vessels or projectile points are found, either category may be more common than ground stone artifacts, which tend to be very durable. Thus, the low typological variability and low quantity render them less analytically attractive for some studies. In addition, even though ground stone tools were used in a variety of activities unrelated to food production, archaeologists still associate them closely with the mundane, usually female, tasks of food preparation and often assume that their uses are self-evident or, worse, uninteresting. And, admittedly, these artifacts can be large and cumbersome,
which makes collection, transport, and permanent curation challenges that many are unwilling to face. It is the sad reality that large stone artifacts are still abandoned in the field at too many sites, never to be properly studied or published. Contributors to this volume note other reasons why ground stone has been neglected in their research areas.

Ground stone studies are much more developed in some regions than in others. In general, archaeologists working in the New World and Australia seem to have dedicated much more analytical attention to ground stone artifacts than those working in much of the Old World, especially those who focus on the historic periods. This might be explained by the availability of ethnographic data on those continents—archaeologists have had the benefit of a long tradition of ethnographic observations since colonization in determining the use of certain stone artifacts. It may also be a result of the emphasis on chronology that is still characteristic of some Old World projects, such as in the southern Levant. Although chronology is a fundamental concern to archaeologists, the amount of research effort placed on resolving chronological issues varies greatly. Research in New World archaeology appears less focused on chronological issues and more successful at exploring the context, both culturally and technologically, of ground stone to study other topics, such as diachronic changes in subsistence patterns. From the perspective of those working primarily in the eastern Mediterranean, scholars of New World archaeology appear to have developed more sophisticated approaches to utilizing ground stone assemblages. This reflects, in part, a positive aspect of the greater impact processual models had upon anthropologically oriented archaeology in the New World, with the emphasis on quantified methodology to answer questions centered on subsistence, production, and environmental questions. In some areas of the Old World the influence of processual models came much later, if at all, and traditional culture historical approaches remain predominant.

**Early Ground Stone Studies**

The assumption in the late nineteenth century was that the earliest tools of ‘uncivilized peoples’ would be chipped stone tools, and that later, as agriculture developed and became the foundation on which civilizations were built, ground stone tools were developed (McGuire 1893). However, recent studies suggest that the earliest stone tools associated with hominin remains were probably made from blocks and cobbles, many of them unshaped, and used as ‘pitted anvils’ (de Beaune 2004; Leakey 1971; Leakey 1976; Leakey 1994). Similar tools have been discovered at the Lower Paleolithic Acheulean (ca. 0.78 Ma) site of Gesher Benot Ya’aqov, Israel located in the Dead Sea Rift (Goren-Inbar et al. 2002).

Early archaeological approaches to the study of ground stone artifacts were often part of general studies of stone tool manufacture by aboriginal or recent descendants of indigenous groups who still had knowledge of ancient ways. One of the pioneers of collecting ethnographic observations, both firsthand and from other ethnographers, was William Henry Holmes. In *Handbook of Aboriginal American Antiquities, Part I*, Holmes compiled an exhaustive reference work, the principal purpose of which was ‘to assemble and present the antiquities of the continent in such a manner and order as to make them readily available to the student who shall undertake to present a comprehensive view of the evolution of the culture among men’ (Holmes 1919:xiii). Holmes recognized a larger research goal beyond description. He had already published his comparative study of raw stone material, manufacturing waste distribution, and tools in the tidewater country around Washington, DC, which was an effort to establish the distribution of chipped stone tools and debris and their origins. Holmes recorded the rejected, incomplete tools in quarries, disproving the then-current claim that the tools were Paleolithic in age. Documenting his investigation of a soapstone quarry within the District of Columbia a few years prior, he included quarrying tools used in the vessel
manufacturing process (Holmes 1890:fig.6). His other investigations in the area identified steatite quarry areas at Piney Branch and Rose Hill, including study of the trenches, quarrying tools, shaping of vessels and rejects that included ‘cut, pecked, ground and polished implements … quarried in hundreds of places along the eastern border of the highland’ (Holmes 1893:9) such as mortars, pestles, axes, picks, hammerstones and a variety of other implements.

Despite these auspicious beginnings, interest in ground stone apparently waned. Already in the early part of the twentieth century, the lack of interest among researchers of the American southwest was noted, despite the initial descriptive documentation of the nineteenth century (Bartlett 1933). A similar trend is evident in the Near East, where early observers provided detailed reports of daily life that included grinding implements (Dalman 1933). With the adoption of modern technology and domination of industrial technology, traditional manufacturing and subsistence practices were abandoned in many regions and ethnography came to be viewed as less relevant to understanding the archaeological past, with some notable exceptions (Kramer 1979).

The resurgence of interest in understanding the origins of domesticated plants meant that ground stone tools sometimes featured prominently in studies of early agriculture in many parts of the world. Many earlier archaeologists worked on the assumption that the transition from reliance on wild plants to domesticated species was marked by changes in food-processing technology, particularly ground stone artifacts. Such a premise is entirely reasonable but has proven difficult to demonstrate, and variable according to region. Regardless of region, analytical studies that incorporate ground stone assemblages seem to typically build upon a similar assumption that artifact morphology directly reflects the function of an object. For instance, studies of hunter-gatherer transitions to sedentary populations frequently assume that mortars were used for nut and acorn processing, and that grinding slabs or **metates** reflect a tool dedicated to reduction of cereals (Schneider 1993). In California, for example, mortars and pestles are generally associated with acorn processing, one of the fundamental staples of indigenous populations. For this reason, research focused on the distribution of the mortar and pestle as an indicator of acorn subsistence, although it is unclear that this is a reliable indicator of initial acorn exploitation (Jones 1996). In addition, ethnographic accounts do not support the exclusive use of mortars and pestles for acorn processing, although intensified subsistence is likely (Basgall 1987).

In the Near East, the long-held belief was that mortars were tools for the reduction of wild, gathered foods such as acorns and nuts, while grinding slabs were used for processing domesticated cereals. Using both experimental data and ethnography, Wright effectively challenged this assumption. She notes that tool morphology is not a dependable gauge of specific function or diet (Wright 1994). The identification of starches representing wild barley (*Hordeum*) processing on a grinding slab at the Epipaleolithic (19,500 14C yr BP) site of Ohalo II, on the shore of the Sea of Galilee, Israel (Piperno *et al.* 2004) further supports the lack of simple correspondence to a single material. A correlation between tool morphology and the shift to increased dependence on agricultural products was also a presumption of archaeologists in the US southwest. In some areas, basin and slab **metates** were considered corollaries to wild plant processing and trough **metates** to agricultural production (Adams 1999); in other areas, ecological models that rely on the assumption that milllingstones must equal plants was challenged (Sutton 1993). Similar assumptions are fundamental to interpretations in the Orinoco Valley, Venezuela and greater Amazonia, where some artifact assemblages are considered evidence for the processing of bitter manioc, while others, such as **manos** and **metates**, are deemed indicative of maize processing (Perry 2004).

Numerous studies, particularly ethnographic and ethnoarchaeological, provide cautionary tales, underscoring the need to avoid oversimplification of grinding implement function (David 1998; Gould 1971; Roux 1985). These and other ethnographic observations clearly demonstrate that tool use is often more complicated than scholars commonly assumed, and that many tools are multi-functional.
Constraints and Problems in the Nature of the Artifacts

Particular drawbacks to the study of ground stone assemblages include the expedient nature of many stone artifacts, confirmed by ethnographic observations which indicate that people will frequently use a cobble for a variety of pounding and grinding activities (Gould 1971), or use a grinding slab or mortar to process a variety of substances (Cane 1989; Smith 1988; Smith 1989). In addition to demonstrating possible multi-functionality, ethnoarchaeological studies underscore the further complicating factor that people will re-use ancient stone tools where available, particularly if sources for manufacturing new implements are not immediately accessible to the habitation or work area (Roux 1985). Recently abandoned sites were also useful sources for the procurement of artifacts, whether fragmentary or complete (Huckell 1986, cited in Schlanger 1991), either as tools or in secondary contexts such as building materials or hearths (Camilli et al. 1988, as cited in Schlanger 1991); implements broken during rejuvenating processes may be discarded, or they may be used for a related function. Ground stone tools commonly remain on sites, and we would expect to find greater investment in tool design where people intended to return to a site (Nelson and Lippmeier 1993). That possibility may have far-reaching implications because any observed trend toward increasing numbers of ground stone implements at a single locus may not be an accurate reflection of increased ground stone use, but may be evidence for recycling of earlier implements by later occupants and their subsequent deposit in the later occupation contexts (Simms 1983).

Constraints and Problems Related to Classification and Typology

The profusion of terminologies and overlapping types was noted decades ago (Hole et al. 1969:170) and continues, varying according to region, sub-disciplinary tradition and, apparently, individual preference. In part, this reflects our lack of ability to identify the functions of tool types. However, there is a trend toward some consensus on some of the major tool types, although these trends may be more pronounced and cohesive in the New World than the Old. This is evident in the terminology used by the authors of the papers in this volume; the reader will note the variety of terms used to describe similar tool types.

The lack of agreed-upon typological classifications certainly frustrates attempts to begin comparative regional inter-site studies and impedes even the effective utility of descriptive reporting of single site artifact assemblages, but this drawback may have a hidden advantage. In many other material culture assemblages, the opposite problem manifests itself: where material culture and chronological frameworks are so fundamentally intertwined neither can serve as an independent control on the other—as is the case in the southern Levant, for example, where the chronology of the historic periods is founded on ceramic typologies developed a century ago. Nevertheless, the lack of typological agreement sometimes hampers efforts to undertake comparative, quantified regional analyses. However, this book contains contributions by scholars specializing in a variety of regions and time periods, and editorial insistence on standardized terminology could increase a loss of information. As a result, the editors provided authors with general guidelines for preferred terminology to facilitate comparisons, but deferred to a contributor’s expertise for specific terminology. We suggest, at least for broad classes of artifacts, a general terminology could be adopted that allows a common lexicon for researchers. Despite these constraints, most archaeologists would agree that many stone artifacts form the primary tool kit for food and other manufacturing processes, and are thus essential to understanding past daily activities. Thus, ground stone tools offer potentially fresh insights into a range of diverse social processes, as the papers in this volume attest.
Stone tools are well-suited to the application of a variety of experimental and analytical techniques. Although still in their infancy, these approaches provide one of the fundamental directions in which studies of ground stone tool function will go to provide fresh perspective. The final form in which archaeologists discover an artifact is the product of a variety of processes, including intentional design, use modification, re-use and post-depositional alteration. Much of the research on ground stone focuses on determination of function, and this has begun to refine our understanding of how grinding implements were used. A variety of approaches attempt to tackle this problem by establishing new ways in which to interpret function independent of tool morphology. The results of these studies will eventually correct interpretations based on the assumption that artifact form equals function.

Experimental Approaches
An early proponent of experimental work, Joseph D. McGuire discussed experimental work aimed at understanding the potential functions of ancient tools (McGuire 1891; McGuire 1892). McGuire (McGuire 1893:311) argued that, contrary to popular opinion of the time, the ‘art of grinding and battering stone must have preceded that of chipping’. However, little experimental work focused on ground stone artifacts until much more recently. Replication and use wear analyses that build upon the seminal work of Semenov (1973) and Keeley (1980) are now widely applied to understand the function of chipped stone tools but only a few similar studies have been applied to ground stone artifacts, despite early insights that included ground stone examples (Semenov 1973:134–42). These approaches are increasingly used in conjunction with other techniques, in particular analytical identification of residues and microbotanical traces.

Replicative Studies and Use-wear
Ground stone artifacts are typically described and classified according to similarities based on morphology. Very often, function is inferred based on the morphological form of a stone artifact and raw material used. As noted above, tool morphology is a poor indicator of stone tool functions, and morphology of grinding and pounding tools may be an unreliable indicator for materials processed. There are several ways to move beyond the inferred understanding of function based on form. Ethnographic observations are commonly investigated in order to make analogous inferences about the function of an archaeological artifact based on the observed use of similar artifacts. Experimental work focuses upon the use of replicated tools based on ancient examples in order to observe wear, rates of wear, polish development, and kinetic patterns. In order to understand chipped stone tool function, increasingly sophisticated techniques of replication and use-wear (Ahler 1979; Bamforth 1988; Hayden 1979; Hayden and Kamminga 1979; Nance 1971; Tringham et al. 1974; Unger-Hamilton 1989; Vaughn 1985) have established the potential of this approach for understanding tool function, but application of similar studies to ground stone artifacts remain few. The most exhaustive sequence of investigations was conducted by Adams in a series of essays (Adams 1988; Adams 1989a; Adams 1989b; Adams 1993a; Adams 1993b) and further explored in Ground Stone Analysis: A Technological Approach (Adams 2002). Other experimental efforts in ground stone include replication and use-wear studies of handstones, grinding slabs, mortars and pestles (Dubreuil 2004), analysis of hammerstones and the debitage from their production (Pritchard-Parker 1998), grinding slab rejuvenation (Pritchard-Parker 1993), wear rates (Wright 1993), and combinations of experimental and ethnohistoric work to understand the relationship of mano surface area to changes in metate form (Mauldin 1993). The logistical difficulty of microscopic examination of large ground stone tools remains a major obstacle to analysis. In addition, superior results are documented for microscopic use-wear of finer flints over coarser materials; many ground stone tool classes are chosen...
for the coarseness of the material. This will render microscopic use-wear analyses more difficult in many cases, although this may enhance preservation of residues and microbotanical remains.

Residue and Trace Analyses
Chemical residue and microbotanical analyses of grinding implements have begun to produce reliable data on the natural resources and technologies involved in the grinding and pounding process. Methods developed include plant tissue identification such as cellular structure, starch grains, phytoliths and resins, as well as other approaches involving biochemical and genetic techniques. Under this broad heading a number of different analytical techniques are included, some still controversial or in experimental stages. For instance, initial claims for the identification of blood residues using a crystallographic method for hemoglobin identification (Loy 1983) were effectively challenged (Cattaneo et al. 1993; Eisele et al. 1995; Garling 1998; Smith and Wilson 1990; 1992). More accurately termed protein residues (Newman et al. 1997), such analyses now use other techniques such as crossover immuno-electrophoresis (CIEP) and enzyme-linked immunoabsorbent assay (ELISA) primarily applied to a variety of stone tools, typically chipped stone. Results of these techniques have been sharply criticized (Fiedel 1996) and defended (Newman et al. 1997) but the application shows potential (Hyland et al. 1990; Kooyman et al. 1992). Most applications have focused on chipped stone tools, in particular those from North American contexts (e.g. Bruier 1976; Loy 1992; Loy and Dixon 1994) although an early innovative application specifically focused on ground stone assemblages from southern California (Yohe et al. 1991).

Lipid (fats and oils) extraction and analysis using gas chromatography (GC) and gas chromatography/mass spectrometry are typically applied to ceramic vessels. Applications to ground stone artifacts, largely limited to New World assemblages, have not been widely tested. Fatty acids, the major constituent of lipids, are typically abundant and insoluble in water, which makes them good candidates for residue analysis. Nevertheless, there are complications in identification and understanding decomposition rates, requiring experimental work to determine fatty acid composition and possible degradation through comparison to modern samples subjected to cooking (Quigg et al. 2001). Other experimental studies further suggest that comparison of natural lipid concentrations of rocks should be made in order to establish a baseline distinguishing culturally introduced lipids from those occurring naturally (Buonasera 2005). Nevertheless, the long duration of ground stone tools in food preparation suggests that lipid analyses will prove an important avenue of future study.

Starch analyses on prehistoric stone tools also show great promise, although most applications concentrate on understanding the role of tuberous plant remains in the shift to cultivation in the New World (Piperno and Holst 1998, and references therein) and Australia (for discussion, see Fullagar 1998). Studies focused on grinding implements (‘edge ground cobbles’, possibly used for tuber processing) rather than chipped flint tools provide evidence that starch grains can be isolated and identified, with rough use surfaces providing the best surface for retention and preservation of starch grains (Piperno and Holst 1998:772), although their presence on polished, chipped stone tools is also documented (Loy 1994). Study of the ground stone tools in the Neotropical forest demonstrated that the tools were used not only to process tubers, but a variety of other plants, such as palms, legumes and small-seeded varieties of maize as well (Piperno and Holst 1998:773). Analyses of starches recovered from ground stone and flake tools from the Orinoco Valley, Venezuela disproved the commonly held assumption that manos and metates are indicative of maize processing, while other tools are functionally related to manioc processing (Perry 2004). Pollen analyses would also seem relevant (Pritchard-Parker 1996), although in combination with other techniques as a control against the problem of airborne contamination.

Integrative approaches combining use-wear, residue and lithic technology seem the most promising. Various combinations have been applied, generally to chipped stone tools (Brass 1998; Kealhofer 1999) but are appropriate for ground stone (Field 1998; and Fullagar et al., this volume).
Other laboratory techniques, such as DNA residues, remain untried on ground stone tools to our knowledge, but have shown promise through application to ancient chipped stone tools (e.g. Shanks et al. 2004; Shanks et al. 2005). Multiple tests could become necessary where tools may have been used for a variety of materials (Babot and Apella 2003).

**Provenience Studies**

Investigating the origins of materials used by ancient people is a well-established and vast avenue of study within archaeology, although application to stone typically focuses on luxury goods and exotic artifacts. A vast array of characterization techniques are employed to establish the origin of materials and their distribution from their geological sources, but interpretation of this evidence requires other techniques of spatial analysis, often modeled on ethnographic analysis (Renfrew and Bahn 2001:359). Larger stone grinding tools are less frequently subjected to these analyses because of the common perception that the lack of portability and general availability of the raw materials precluded the exchange of these materials (Biskowski 2003). Yet, to take an example from the Near East, Natufian (12,500–10,200 BP) populations exploited more distant basalt sources rather than those available closer to home, presumably because of the superior qualities of the distant flows (Weinstein-Evron et al. 1995, 1999, 2001). By the Roman period, basalt was traded for large milling implements across the Eastern Mediterranean (Williams-Thorpe and Thorpe 1993; Williams-Thorpe et al. 1991; Xenophontos et al. 1988), the Adriatic (Antonelli 2004) as well as southern Europe and North Africa (Peacock 1980). The assumption that stone would be sought and exchanged over large distances only if a semi-precious or ore-based material should be reevaluated.

**Organization of this Volume**

Several of the papers in this volume began as presentations at the Annual Meetings of the American Schools of Oriental Research (2001–2003) in sessions devoted to the presentation of ground stone studies from sites in the ancient Near East chaired by the editors. The interest in these sessions and the contacts made among the relatively few ground stone specialists working in this region led to this volume of papers devoted to ground stone studies. Ground stone specialists working around the world were also solicited for papers in order to expand the volume, and we were overwhelmed by the response. It is clear from the interest and enthusiasm expressed by the contributors in this volume and other ground stone specialists who could not contribute that such a volume is long overdue.

The papers are organized into three thematic sections, although overlap between papers in these sections is frequent. Jane Peterson’s incisive contribution (Part IV) provides a detailed discussion of themes presented in each paper; therefore, an introduction to the papers will be brief.

**Part I: Production and Exchange**

Part I includes eight papers that deal with issues of production and exchange of ground stone artifacts. These processes are essential to understanding not only the utilization of resources and distribution of items, but also the information necessary to infer patterns of socio-economic organization, social interaction and communication at the inter- and intra-regional levels.

Two studies report on the identification of quarry and production sites. Drawing on their previous fieldwork at quarrying and production sites in western North America, Schneider and LaPorta use geoarchaeological field techniques to identify basalt vessel and implement extraction and production sites in the southern Levant. Harrell and Brown present their discovery of six Islamic-era quarries for steatite cooking vessels in Egypt’s southern Eastern Desert and revise
the view that Arabia was the principal source for steatite vessels in the Middle East during this period.

Carter and Rassmann focus on the use of ground stone implements in the production of specialized stone objects. Through an examination of the stone implements made of non-local amphibolite that were used to carve stone vases used for feasting activities in Late Bronze Age Crete, Carter investigates the social context of production of these elite vessels. Rassmann suggests that handstones were used to carve the unusual sandstone rings found in quantity at the Pre-Pottery Neolithic site of Ba’ja in Jordan, thus demonstrating that these tools, which are usually identified as food processors, could have other uses as well.

Early Bronze Age production and exchange networks in the southern Levant are the subject of two studies in Part I. Abadi and Rosen reconstruct the ground stone production and distribution system in the Negev Desert in Israel during the Early Bronze Age through the examination of waste products and finished implements from three recently surveyed or excavated sites. Milevski discusses the exchange of ground stone tools and vessels during this period using a variety of sources of evidence, and concludes that ground stone was integrated with dispersal networks for other commodities, including metals and pottery.

Two papers consider the production and exchange of ground stone artifacts in more general discussions of this equipment in disparate regions. Using diverse assemblages excavated from several Neolithic sites in Western Asia, Wright considers a number of issues related to tool production and use, including the use of ground stone tools in several craft traditions that emerged during this period. Biskowski presents a discussion of prehispanic maize-grinding tools in central Mexico and, applying insights gleaned from artifact attribute analyses and source analyses, suggests that specialized tortilla production arose at the cities’ margins in response to increased fuel consumption and costs.

Part II: Interpreting Function, Primary vs. Secondary Use

Seven papers confront a variety of subjects relating to the assessment of the physical context of artifact use and discard; these give insights into not only the function of these artifacts, but also the social context of their use. Ethnographic studies in both the New and Old Worlds indicate that archaeological sites are desirable sources of grinding implements. Without understanding the effects of ground stone reuse, our estimation of diachronic changes in ground stone assemblages may be inaccurate. A consideration of the physical evidence for artifact use and reuse is most appropriate for understanding the long and complex life-histories of these uniquely durable objects.

Four papers reconstruct ground stone artifact use and reuse through a variety of approaches. Fullagar, Field and Kealhofer identify the remains of Poaceae starch grains, phytoliths and fern and lily starch on a ca. 27,000-year-old grinding slab from southeastern Australia; this physical evidence for grass seed processing challenges the notion that social and technological change was restricted to the Holocene in this region. Valado reports the results of a series of pottery-polishing stone replication experiments and explores the implications for interpreting archaeological specimens from the Mogollon Rim in East-Central Arizona and their role in craft production during the Pueblo III-Pueblo IV transition. Liebowitz combines textual and iconographic sources with insights gleaned from ethnographic observations to interpret wear patterns on handstones used to grind grain excavated at the Bronze-Iron Age site of Tel Yin’am, Israel. Basgall, through an assessment of the use, reuse, and discard patterns of a large assemblage of handstones and grinding slabs, investigates the variation in the organization of hunter-gatherer milling technologies in the northern Mojave Desert in North America.

Three authors consider discard patterns of stone artifacts and their use in reconstructing prehistoric behavior in diverse contexts. Adams discusses the widespread phenomenon of the purposeful
destruction of ground stone artifacts and, using ethnographic analogy from the US Southwest, builds a framework for evaluating broken objects found deposited in intentional deposits for insights into ritual behavior. Kadowaki reconstructs the life-histories of residential buildings in Neolithic Ayn Abu Nukhayla, Jordan, through the spatial analysis and site formation processes of ground stone tools and other refuse of domestic activities. In a paper that reviews the important role that ground stone artifacts play in modern research in the US Great Basin, Kolvet discusses such issues as the reconstruction of women’s space and the social aspects of grinding, and the reuse of grinding equipment by Paleoindian and Paleoarchaic peoples.

Part III: Symbols of Luxury and Ritual Equipment

Part III includes five papers that explore the use of ground stone artifacts as symbols of luxury and ritual equipment. Ground stone artifacts are primarily considered food production tools, but they frequently serve as equipment for ritual processes occurring in temples, sacred precincts and mortuary rites. In addition, stone artifacts may serve as prestige goods conferring or reaffirming the status of the owner. Investigation into the ritual and symbolic associations of the artifacts permits us fresh glimpses into the cognitive realms. Specialized production is frequently related to ritual events, including both mortuary and non-mortuary ceremonies.

Two authors consider the function of specialized stone vessels as funerary objects. Schaub focuses on the corpus of well-carved basalt bowls excavated in shaft tombs at Bab edh-Dhra’, Jordan, and reconstructs an estimate of their symbolic and material value for this Early Bronze Age society. Roosevelt considers the funerary use of stone alabastra in western Anatolia during the sixth–fourth centuries BC and suggests that these vessels were made popular through their associations with Lydian and Persian royalty and their very orientality.

Two studies focus generally on the ritual associations of stone vessels found in very different contexts. Luke’s interdisciplinary study of three styles of Late Classic vases from Mesoamerica concludes that marble, alabaster, and travertine vases represent true luxury goods reserved exclusively for royalty. Amit, Seligman, and Silberbod report on the excavation of two man-made caves in Jerusalem that functioned as a quarry and workshop for limestone vessels and ossuaries produced during the Second Temple (Roman) Period, the former in accordance with the requirements of Jewish purity laws.

In an effort to gain a more complete understanding of the value of these artifacts in past social systems, Rutter and Philip build upon the results of recent geochemical analyses of ground stone artifacts in the southern Levant. Although specific basalt vessel manufacturing localities have yet to be identified during late prehistory, Rutter and Philip use the growing database of geochemical analyses of basalt artifacts and flows to posit that social factors could be as, or more important than, a rock type’s physical properties.

Concluding Remarks

Ground stone tools are embedded in a broad collection of activities ranging from highly mobile hunter-gatherers to fully sedentary inhabitants of urban settlements, and as such are relevant to an enormous pool of potential research questions. As Peterson notes in the concluding paper, the diversity of material culture and analytical approaches is matched by the range of theoretical perspectives engaged by authors in this volume, reflecting trends and debates across the discipline. These studies indicate that despite a continued interest in the quotidian realm—commonly assumed to be the extent of ground stone tools—the role of stone objects in ritual activities, gendered activities, elite exchange and burial or social emulation also engage these researchers.
While recognizing the importance of the innovative approaches in this volume, descriptive and classificatory reports remain an essential component to advancing studies of ground stone analyses; without them, we would lack the future possibility of using quantification and comparison of assemblages to investigate the relationship between artifact morphology, manufacturing, and reuse, regional and spatial variability, and the socio-economic context in which these objects were produced, exchanged and abandoned. It is essential, then, to continue to move past poor collection, curation and reporting habits of ground stone assemblages if we are to establish the utility of ground stone artifact analysis to broader research questions. The studies collected in this volume indicate that scholars are moving in the right direction in establishing new innovative parameters for analysis beyond description and classification.

Acknowledgments

The editors wish to thank all of the contributors for their efficiency and perseverance. This volume has benefited from the insights of and discussions with Steve Simms, Ian Kuijt, and Jane Peterson. In addition, we would like to gratefully acknowledge the efforts of Paul Steinle (University of Notre Dame) and Monica Selak (University of Notre Dame), Hannah Braxton (University of Evansville), Glenda Smith (University of Evansville) and Jon-Paul McCool (University of Evansville) in various stages of the editing process. The efforts of an anonymous reviewer are also greatly appreciated.

References


INTRODUCTION


