Sweet Waste: Medieval Sugar Production in the Mediterranean viewed from the 2002 Excavation at Tawāḥīn es-Sukkar, Safi, Jordan, by Richard Jones. Potingair Press, 2017. 245pp. Pb. £45.00. ISBN-13: 9780956824035.

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True to its title, *Sweet Waste* is a study of the industrial waste produced by medieval Islamic sugar production, based on the author's excavations at the site of Tawāḥīn al-Sukkar in southern Jordan. Taking the form of an abbreviated final field report, the work offers new perspectives on the technology of production of a commodity that occupied a central position in the agricultural economy of the medieval Mediterranean, yet left no remains of its product (p. 197). The monograph is divided into nine chapters: the first three survey what is known in terms of the history, technology, and archaeology of medieval sugar production; and the remaining six form something of a final field report, with chapters authored by different project specialists.

Chapter One makes the case for the topic that is at the core of this work: an archaeological study of the technology of sugar production in the medieval Levant. The history of the sugar industry has largely been written by historians, pulling on period texts (and largely travelers' accounts). Archaeological scholarship has been surprisingly limited, with most excavations concentrated in Cyprus, Israel, and Jordan. This scholarship has generally focused on the buildings themselves (the mills) and industrial pottery (sugar molds and molasses jars), contributing little to our understanding the technology of production and the resources required. The author's single season of excavation at the sugar production site of Tawāḥīn al-Sukkar and the supporting village of Khirbat Shaykh 'Iṣā (associated with Biblical Zoara) provide the ideal context for studying the operations of this industry in its larger human and natural landscapes. The production site, moreover, has preserved quantities of industrial debris, making possible reconstructions of the boiling and clarifying processes. Unlike wine and olive oil production, the processing of cane sugar does not leave an organic residue, making more traditional forms of ceramic analysis irrelevant. The debris is, thus, the key to reconstructing this process. The Glasgow excavations at both sites took place for a single season in 2002 and were preceded by several topographical and geographical surveys conducted in 1999 and 2000. The project complements that of the Hellenic Society for Near Eastern Studies, directed by Konstantinos Politis from 1997 to 2018. (The final report of this two-decade-long project is currently in print – Politis 2018.) Surprisingly, Jones does not cite Politis' recent conference volume (Politis 2015), which includes contributions about the Khirbat Shaykh 'Iṣā excavations.

The following chapter surveys the historiography of sugar production, from the domestication of sugar cane before 8000 BC to its commercialization in the eastern Mediterranean in the 9th–18th centuries. Avoiding such topics as the organization of labour, scale of production, and the economics of the industry, which have been covered in other historical studies, Jones

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focuses on the most technical aspects of production. Chapter Two surveys the diffusion of the crop and the technology of production over time and space; the agricultural framework of production (read against the backdrop of Watson's now classical, though outdated, study of the Islamic "agricultural revolution"); and, most importantly, the production process. Unsurprisingly for this study, clarification of the sugar is highlighted in a larger process that includes cultivation, harvest, cutting and pressing, and boiling. The technical portion of Jones' monograph, then, focuses on the identification in the industrial waste of those chemicals known to have been used as clarifiers in the medieval Levant: potash (from wood ash), natron, alum, lime, and sulfur (found in egg white).

Chapter Three provides a convenient reference to all published archaeological studies of medieval sugar production, spanning fieldwork in Iran, Greater Syria, Egypt, Cyprus, North Africa, and Spain. The final section is devoted to a survey of scholarship on "sugar pots" (both molds and molasses jars). Chapter Four begins what actually functions as a field report, describing the physical environment and natural resources of the area. Previous archaeological explorations in the region are also described. The stratigraphic report of the 2012 season is found in the following chapter and provides the general site phasing for the chapters that follow.

Chapters Six through Eight comprise the specialists' reports. Here is where the volume breaks down, as the reports are relatively brief, are of uneven quality, do not pull on recent scholarship, and are not effectively incorporated into the larger study of sugar production. The longest of the reports, on ceramics, is a traditional presentation of the ceramic assemblage. Because of relatively poor stratified contexts, and high residuality, dating had to rely largely on published parallels. The first half of the chapter presents the pottery collected from both sites on the scale of assemblage and then with discussion of individual forms and wares. It is not clear from the presentation what the stratigraphic contexts are. Fabric descriptions are limited in this section (probably because the Middle Islamic wares, in particular, are well known, and laboratory analysis of clays is presented later in the chapter); it, nonetheless, makes regional comparisons with other assemblages of known production centers impossible. The published parallels rely heavily on the unstratified material of Karak Castle, rather than the rapidly expanding scholarship on well stratified Middle Islamic (Ayyubid and Mamluk-era) pottery from the Petra Valley (references in Sinibaldi 2013 and preliminary reports from Beidha in *Annual of the Department of Antiquities of Jordan*), the ongoing University of Florence excavations at Shobak Castle, and the long-term fieldwork at Tall Hisban (Sauer and Herr 2012 and preliminary reports in the *Annual of the Department of Antiquities of Jordan*). Missing, as well, is an explanation of collection and selection strategy: was 100% of all soils sifted, what was sampled for analysis and on what basis? The chapter concludes with a comprehensive and very useful report on the results of petrography and chemical (XRF) analyses, and SEM examination, of sherds (including wasters). (XRD was apparently not included in this analysis.) Significantly all six fabric groups identified in this manner appear to have been local. Brief reports on the small finds (mostly recovered from Khirbat Bayt 'Iṣā)—glass, coins, plaster, and iron and clay industrial waste—appear in Chapter Seven.

The heart of the monograph is to be found in Chapter Eight, which is devoted to the analysis of organic remains, including bone, plants, charcoal, and industrial waste. The comprehensive zooarchaeological report makes important conclusions regarding site function: Khirbat Bayt 'Iṣā was a consumer site, not a producer, as there was no evidence for any animal processing

on-site. What is missing from this report, however, are any comparisons to the larger food economy of the region, as none of the highly relevant zooarchaeological studies from excavations in the region have been cited (ex. – Brown 2010 and 2016 and Brown and Rielly 2010 and 2016 for Shobak, Karak, and al-Wu'ayra castles; LaBianca and von den Driesch 1995 for Tall Hisban). The macrobotanical report is painfully brief and not integrated into the larger study. There would have been considerable potential for this section to reveal ways in which the village functioned in relation to the mill, and one wonders why there was no botanical analysis of the production waste. It is not clear that flotation was done at all to recover the macrobotanical material. The analyses of the charcoal and industrial waste, for reconstruction firing conditions and the process of sugar clarification, are excellent. The charcoal, from domestic middens and the industrial waste, was subjected to carbon isotope analysis, suggesting that the waste included incompletely burned fuel within the ash. While the results were not conclusive, it seems that bagasse (of crushed sugar cane) was used as fuel for boiling. (Phytolith analysis was not conducted in this project, but the results of phytolith analysis in Politis 2018 may provide confirmation of this picture.) Using household ashes as a reference point, a combined reading of ZRD and FTIR results suggest that local Lisan sediments (high in strontium and calcium content) were used at the site as the main agent for clarification of sugar.

Jones authors his own conclusion to the volume, in Chapter Nine, with a tightly written, and thought-provoking, big-picture assessment of what archaeology can (and should) contribute to our knowledge of medieval sugar production. The relationship of this industry to other industries (cereal production, mining and metalworking) is considered, and the potential of the archaeological record for tracing the technological development of this industry, and its regional variants, is explored.

As a stratigraphic report, and one that present the final results of, an admittedly brief, field project, *Sweet Waste* does not live up to its potential. As a contribution to an archaeology of sugar production technology, it is highly commended. This is a most welcome study and one that will provide a key reference for future investigations of medieval agricultural industries.

References

- Brown, Robin M.
 2010 "Faunal Remains from Excavations in the Palace at Shawbak Castle in Southern Transjordan." *Berytus* 51/52 (2008/2009): 168–198
 2016 "Faunal Distributions from the Southern Highlands of Transjordan: Regional and Historical Perspectives on the Representations and Roles of Animals in the Middle Islamic Period." In *Landscapes of the Islamic World: Archaeology, History, and Ethnography*, edited by Stephen McPhillips and Paul Wordsworth, 71–93. Philadelphia: University of Pennsylvania Press.
- Brown, Robin M. and Kevin Rielly.
 2010 "A Twelfth Century Faunal Assemblage from al-Wu'ayra in the Southern Highlands of Jordan." *Annual of the Department of Antiquities of Jordan* 54: 121–141.
 2016 "Faunal Remains from the Mamluk and Ottoman Occupations in the Middle Islamic Period Palace at Karak Castle, (Qal'at al-Karak)." In *An Archaeology of Agro-Pastoralist Economies in Jordan*, edited by Kevin M. McGeough. *Annual of the American Schools of Oriental Research* 9, 91–134. Boston, MA: American Schools of Oriental Research.
- LaBianca, Øystein S. and A. von den Driesch.
 1995 *Taphonomical and Zooarchaeological Studies of the Animal Remains from Tell Hesban and Vicinity*. Hesban 9. Berrien Springs, MI: Andrews University Press.
- Politis, Konstantinos D.

- 2018 *Ancient Landscapes of Zoara: Surveys and Excavations at the Ghor as-Safi in Jordan, 1997 to 2018*. Monograph series XIX. London: Palestine Exploration Fund.
- Politis, Konstantinos D., ed.
- 2015 *The Origins of the Sugar Industry and the Transmission of Ancient Greek and Medieval Arab Science and Technology from the Near East to Europe*. Athens: National and Kapodistriako University of Athens.
- Sauer, James A. and Larry G. Herr, eds.
- 2012 *Ceramic Finds: Typological and Technical Studies of the Pottery Remains from Tell Hesban and Vicinity*. Hesban 11. Berriens Springs, MI: Andrews University Press.
- Sinibaldi, Micaela
- 2013 "The pottery from the 11th-20th centuries from the FJHP survey: ceramics, settlement, and pilgrimage at Jabal Hārūn during the later Islamic periods." In *Petra, the Mountain of Aaron: the Finnish Archaeological Project in Jordan. Volume III, The Archaeological Survey*, edited by Paula Kouki, Mika Lavento, and Anna Annila. 169–201. Helsinki: Societas scientiarum fannica.