Introduction.
Leave no stone unturned: Perspectives on ground stone artefact research

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Abstract:

Ground stone tools served in many physical and social contexts through millennia, reflecting a wide variety of functions. Although ground stone tool studies were neglected for much of early archaeology, the last few decades witnessed a notable international uptick in the way archaeologists confront this multifaceted topic. Today, with the advance of archaeology as a discipline, research into ground stone artefacts is moving into a new phase that integrates high resolution documentation with new methodological, analytical techniques, and technological approaches. These open new vistas for an array of studies and wide-ranging interpretive endeavours related to understanding ground stone tool production and use. Inspired by these diverse analytical approaches and interpretive challenges, we founded the international Association for Ground Stone Tools Research (AGSTR) in order to promote dialogue and create an optimal, inclusive arena for scholars studying various aspects of ground stone artefacts. Scholars from around the globe met for a five day conference at the University of Haifa, for the first meeting of the newly founded AGSTR. This included the presentation of 47 papers and 17 posters. The current paper serves as an introduction to this special issue of JLS, devoted to the proceedings of the founding conference of the Association for Ground Stone Tool Research, held at the University of Haifa during July 2015.

Keywords: ground stone tools; food production; archaeology; anthropology; AGSTR

Ground stone artefacts served in widely divergent physical and social contexts through millennia, reflecting a variety of functions documented through a century of archaeological, ethnographic, and historical research. An ill-defined group of archaeological artefacts ranging from portable items to large immobile equipment and bedrock features, this broad artefact category cross-cuts geographic and chronological boundaries, from generalized grinding and pounding tools, to more task-specific tools, such as weapons, vessels, and single-function items. For this reason, precise definitions of “ground stone artefacts” are difficult and
frequently pertain to a specific assemblage or group of assemblages (Gopher & Orrelle 1995: 13; Sparks 2007: 1-3; Rosenberg & Garfinkel 2014: XIII).

Scholars define ground stone objects in different ways, producing complex typological and classificatory systems (e.g., Warren 1969; Wright 1991, 1993; Gopher & Orrelle 1995; Rowan 1998; Adams 2002; Beven 2007; Sparks 2007; Rosenberg & Garfinkel 2014). These definitions typically include any item of stone which was manufactured through abrasion, polish, or pounding (impact), or a stone item used for these activities to create some other object. Such definitions rely heavily on the study of discarded finished tools (items in their 'post-production' and often 'post-use' stage) and thus the role of flaking, so central to the manufacturing of many ground stone tool types (Rosenberg et al. 2008) is commonly neglected or its importance under-valued. Moreover, while the production of ground stone tools seems to frequently involve a complex set of technologies and techniques (e.g., flaking, battering, pecking, chipping, drilling incising, abrading, polishing) and production sequences, it seems that the key qualifier for a 'ground' stone item is still, by and large, the actual raw material from which the object was made.

Unlike chipped stone tools, which are typically flint, chert or obsidian, raw material used for ground stone artefacts may be sedimentary, igneous or metamorphic rocks, depending upon factors such as local resources, availability and functional objectives. Scholars have noted the overlap between ground stone tools and chipped stone tools production, and that the categories of chipped and ground stone tools is an artificial distinction (and unrelated to geological rock classification) with greater utility to archaeologists than to the original users (Adams 2002: 1; Gebel 1999; Rowan & Ebeling 2008: 2). This taxonomical difficulty notwithstanding, positive trends in scholarship include the adoption of more methodical approaches, systematic, analytical definitions, and greater grounding in theory and model-based approaches. These encouraging trends are reflected in the present contributions to this issue of the Journal of Lithic Studies.

Ground stone tool studies play an increasingly integral role in holistic archaeological research programs, providing new avenues of research and interpretations. Although traditionally associated with 'prosaic' daily necessities such as food production (e.g., Rowan & Ebeling 2008: 2-3), these important functional roles are often mistakenly treated as their sole, perhaps uninteresting, purposes. The erroneous attitude that most ground stone objects are related to food production reflects a notion that 'we understand how these objects functioned'. This lack of interest may also contain an unspoken assumption that much of this was the work of women (e.g., Rowan & Ebeling 2008: 2). Yet ground stone tools were used to manufacture other tools and goods (e.g., Carter 2008; Harrell & Brown 2008; Rassmann 2008; Schneider & LaPorta 2008), they were used in ritual practice (e.g., Jones 1996; Adams 2008; Graefe et al. 2009; Larsson 2011), were associated with human burials and mortuary contexts (e.g., Ebeling 2002; Schaub 2008; Rosenberg & Nadel 2014), and were sometimes buried themselves (Rosenberg 2013). They were often used in complex systems relating to the consolidation of communities (Wright 2000; Rosenberg 2008; Wright 2014) and reflect the division of labour (Jackson 1991; McGuire & Hildebrandt 1994; Mobley-Tanaka 1997).

Ground stone items had an active, crucial role in a complex array of human activities that occurred in a range of contexts, from the sacred to mundane. Implied in the common assumption that ground stone tool types and assemblages are rarely sensitive indicators in chronological, cultural, or even geographical definition (i.e. that these cannot be used as reliable markers for change or differences) results in a negative feedback: by neglecting the study of ground stone objects, less comparative data was available, hindering the potential analytical value of these items.

At the regional level, ground stone tool assemblages may reflect cultural and economic changes, sometimes notably, sometimes less dramatic. Some regions witnessed a dramatic
rise in overall tool frequencies, typological and stylistic variations, and specific raw material selection, as well as changes in contextual and discard patterns, as seen for example with the Natufian culture of the southern Levant (e.g., Wright 1991, 1994; Eitam 2008; Nadel & Rosenberg 2010; Rosenberg et al. 2012; Valla 2012). In other cases, changes follow the introduction of new foods to a region (e.g., Morris 1990). In some cases, considerable developments are evident in the technological apparatus of tool production and the diversification of production sequences through time, reflecting notable changes in the time and energy invested in tool production.

Ground stone artefacts are used for a wealth of activities beyond grain and fruit processing. These include, for instance, the processing of herbs, minerals, meats, medicine, narcotics, preparation of alcoholic beverages, and more (e.g., Cushing 1920; Woodbury 1954; Gould et al. 1971; Gould 1977; Kraybill 1977; Hayden 1987). Ground stone tools are also involved in the manufacture of a large array of tools made of various materials such as wood, bone, rock and metal (see papers in this issue and refs. therein). Ground stone tools are used in the preparation and plastering of floors and walls, or to store materials and items, or might be used in the presentation and serving of food for daily meals and in special occasions. Ground stone tools sometimes played less well known, yet notable roles, such as textile production, or for hunting, trapping and fishing gear. Some were used in combat, such as the mace heads and sling stones. Albeit more elusive to detect archaeologically, many items embodied symbolic meanings, served as markers of identity, and were imbued with religious or ideological significance.

The significance of ground stone tools cannot be overestimated. Our earliest evidence for hominid tools are worn and damaged unworked stones, perhaps used as pitted anvils and pounding implements (e.g., Leakey 1994; de Beaune 2004 and see references therein). Evidence for the use of expedient, typically unshaped rocks by primates are also known and in the southern Levant early hominid use of stone objects has been reported (Goren-Inbar et al. 2002), indicating that such ad hoc tools were present for many millennia. The rarity of evidence for ground stone food processing tools in the late Lower, and Middle Palaeolithic, before the growing evidence for grinding in the Upper Palaeolithic sites is of note. In recent years, several studies were devoted to the use of modified or unmodified stone implements as food processing tools during the Palaeolithic period, however, so far, most of the known evidence for abrading comes from Upper Palaeolithic contexts (e.g., Aranguren et al. 2007; de Beaune 2002, 2004; Fullagar and Field 1997; Liu et al. 2013; Mariotti Lippi et al. 2015; Piperno et al. 2004; Revedin et al. 2010, 2015; Spivak & Nadel, 2016; Wright 1991: table 1). At least in Europe, such evidence comes from both Neanderthals and modern humans sites (e.g., de Beaune 2004). At least for the Levant it seems that the boost relates to ground stone tools production should be dated to the later parts of the Epipaleolithic period (e.g., Wright 1991, 1994; Rosenberg et al. 2012). The process of neolithisation in the region, and in other regions as well, highlights the role food processing and other tools played in the transition to increasingly sedentary communities practicing full-fledged agriculture (e.g., Wright 1993). Despite their importance to this process, the common assumption that specific tool forms correlate with more mobile hunter-gatherer and sedentary groups is not demonstrated when examined carefully and with quantified data (e.g., Wright 1991).

In some instances, ground stone tools were regarded as prestige items and highly valued commodities, at least in agrarian societies (e.g., Hayden 1998), transporting and conveying significant social information within the society. The significance and social value of these tools are frequently perceived as being directly linked with social and economic processes which characterize changes in society (e.g., Searcy 2011: 3; Peacock 2013: 1-6), when specific trends and conventions developed, and increasing specialized production was noted.
alongside development of complex networks for the distribution of ground stone tools (e.g., Campbell-Smith 1965; Luke 2008; Roosevelt 2008; Rosenberg & Golani 2012).

Despite the centrality of ground stone artefacts in so many diverse lifeways of the past, whether sedentary or mobile, prehistoric or historic, small bands, villages or cities, studies of ground stone remain in their infancy. There are various reasons for this neglect related to their size and weight, their slow pace of morphological change over time, or the curation and reuse of an object for different, secondary purposes, sometimes over a long period of time. Another reason for the de-emphasis on ground stone tool studies may stem from the inclusion of different functional types in the same analytical group, obscuring our ability to recognize meaningful diachronic trends and changes.

In the absence or near-absence of production locales (i.e. quarries, production sites, workshops) in some parts of the world (e.g., the Near East), and the common discovery of finished items in most archaeological sites, the possibility of technological analyses that relates to the earliest stages of the production are greatly reduced. Quarrying, reduction, and shaping that are frequently done at or near the quarry site where the raw material is obtained frustrates attempts to document the chaîne opératoire.

This neglect varies greatly depending on chronological periods studied, quantity of material culture, national traditions of research, and other factors, but ground stone artefacts are frequently relegated to the ‘other’ category of finds (Biskowski 2008: 144). In recent years, however, a change of attitude toward the study of the ground stone tools became evident, with some specific trends becoming clear. One such trend that was reflected in the papers presented during the 1st AGSTR meeting at the University of Haifa, and visible in this JLS issue, is an increase in the number of papers dealing with ground stone quarries, production, and design (e.g., Cook 1973; Hayden 1987; Schneider 2002; Stocks 2003; Truncer 2006; Rosenberg et al. 2008; Anderson & Scarrow 2011; Ebeling & Rosenberg 2015; Vardi 2015; Shimelmitz & Rosenberg 2016; Squitieri & Eitam 2016).

Another trend gaining strength is a focus on geochemistry and provenance, distribution, and exchange (e.g., Williams-Thorpe 1988; Philip & Williams-Thorpe 2001; Watts et al. 2004; Antonelli & Lazzarini 2010; Tsoraki 2011; Rosenberg & Golani 2012; Gluhak & Rosenberg 2013; Gluhak & Schwall 2015; Rosenberg & Gluhak 2016; Gluhak et al. 2016; Reniere et al. 2016). Efforts to understand the functions of stone items continue through increasingly sophisticated functional use-wear analyses (e.g., Hamon 2008; Risch 2008; Verbaas & van Gijn 2008; Delgado-Raack et al. 2009; Bofill 2012; Adams 2014; Asryan et al. 2014; Adams 2015; Delgado-Rack & Risch 2016; Groman-Yaroslavski et al. 2016; Hamon 2016) and residue studies (e.g., Yohe II et al. 1991; Hard et al. 1996; Fullagar & Field 1997; Veth et al. 1997; Piperno & Holst 1998; Perry 2004; Aranguren et al. 2007; Barton 2007; Fullagar et al. 2008; Buonasera 2016; Öğüt 2016). In addition to functional and sourcing analyses, studies dealing with the role of the object in day-to-day activities, and in ritual and their symbolic dimensions, are gaining traction (e.g., Rosenberg & Nadel 2014, Rowan 1998: 324-331; Duwe 2016; Nadel & Rosenberg 2016).

At the same time, growth in the number of ground stone tool assemblage reports (typological and others) is noted, and suggests an increasing acceptance that description is a basic necessity of a complete archaeological report (e.g., Baysal & Wright 2005; Rowan et al. 2006; Stroulia 2010; Rosenberg and Garfinkel 2014; Beller et al. 2016; Cohen-Klonymus & Bar 2016; Greener & Ben-Yosef 2016; Levy et al. 2016; Pedersen et al. 2016; Schneider et al. 2016; Spivak & Nadel 2016). In addition, specific studies dealing with particular segments of the ground stone tool repertoire, some with specific function or functions, are becoming more common (e.g., Takaoğlu 2006; Basgall 2008; Beaumont & Bednarik 2015; Nadel & Rosenberg 2015; Reich 2015; Bekker & Garfinkel 2016; Breglia et al. 2016; Ilan 2016; Larocca 2016; Larocca & Breglia 2016; Rosenberg et al. 2016; Thiébaux et al. 2016;
Usacheva 2016). Studies based on historical sources (see, for example, Lang 2016) and ethnographic observations (e.g., Cane 1989; Hamon & Le Gall 2013; Robitaille 2016) are also significant and important contributions in recent years.

The compilation of information extracted from ground stone tools can be significantly advanced by combining archaeological with scientific perspectives and the application of a broad range of scientific approaches. The value of ground stone tools as containers of information that can be extracted using various micro- and macroscopic techniques, highly advance scanning and documentation methods, residue and geochemical analyses cannot be over-emphasized and may supply us with a wealth of information regarding the processing of subsistence, subsistence economies, production sites, the procurement and distribution of the raw material trading networks, and a plethora other venues.

Inspired by these diverse analytical approaches and interpretive challenges, one of the principle aims of the founding of the international Association for Ground Stone Tools Research (AGSTR) was to promote a dialogue and create an optimal arena for scholars who are interested in various issues related to ground stone artefact studies in this growing area of research. Scholars from around the globe met at the University of Haifa in July, 2015, for a five day conference for the first meeting of the newly founded AGSTR. This included the presentation of 47 papers and 17 posters.

All participants were invited to submit their papers for peer-review and inclusion in this special volume of *Journal of Lithic Studies* that finally includes 29 contributions. The diverse range of papers reflects the broad range of vibrant research into aspects of ground stone objects that rely on a host of different analytical techniques, some combining multiple techniques, demonstrating the vitality of this sub-field of archaeology. The success of the first AGSTR meeting and its proceedings points the way for the prospects of ground stone tools studies and the growing impact these studies are making. Now, with the founding of the new Association for Ground Stone Tool Research, the forming of AGSTR new website and Facebook, we have a suitable infrastructure to promote these venues, produce more research collaborations, promote integration of new methodologies and techniques, and advance ground stone tool studies and their interpretive potential to contribute to the wide array of research questions pertaining to the changes of human society through millennia.

**Acknowledgments**

Many people were part of, and made possible, the successful 1st meeting of the newly founded Association for Ground Stone Tool Research (AGSTR) and the proceedings published in *Journal of Lithic Studies*. Our thanks go especially to D. Faraggi, Rector of the University of Haifa, R. Snir, Dean of the Faculty of Humanities and A. Refter Head of Administration of the faculty, The Zinman Institute of Archaeology and its head M. Weinstein-Evron, and its manager M. Eisenberg and to Johannes Gutenberg University and W. Hofmeister for their support and endless encouragement. We also thank the Israel National Commission for UNESCO and its secretary general D. Atrakchi, to the W.F. Albright Institute of Archaeological Research, Jerusalem and its director M. Adams, and to BETA Analytic for supporting the conference. Special thanks also go to O. Crandell, Editor-in-Chief of *Journal of Lithic Studies*, and to O. Bar-Yosef, our keynote speaker. We also would like to thank T. Laviel for her expert help before and during the AGSTR meeting; to A. Zohar and M. Bugaev for designing the conference website, to A. Regev for her patient assistance with all graphic design matters and to I. Rosenberg for designing the AGSTR logo. We also thank Dr. Z. Tsuk and E. Hefez of the Israel Nature and Parks Authority and the many researchers of the Israel Antiquities Authority and other institutions who allowed us to examine the ground stone tools from their excavations. And last, but not least, the students of
the Laboratory for Ground Stone Tools Research at the Zinman Institute of Archaeology, University of Haifa, M. Agnon, B. Tzin, S. Pinski, T. Shooval and S. Bar-Giora for their patient and indulgent assistance, and their contributions for the successes of the 'Ground Stone Tools and Society' conference. Special thanks go also to S. Pinsky and R. Chasan for their patience checking and formatting all contributions for this special issue of Journal of Lithic Studies and to all the reviewers who kindly agreed to review the contribution of this special issue of Journal of Lithic Studies.

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