

Burin Variability at Neolithic 'Ayn Ghazāl, Jordan

Introduction

Burins constituted the predominant tool class at Neolithic 'Ayn Ghazāl (Rollefson *et al.* 1992: TABLE 4), and this situation is repeated at most Neolithic sites in the Near East. The role of burins remains enigmatic, but the importance this tool class held for Neolithic social groups must not be ignored because of this difficulty. For the moment, at least, we are left to consider specific changes in burin manufacture and how these standards relate to other patterns of socioeconomic developments during the Neolithic of the region.

Burin Typology

One problem that inhibits meaningful assessments of changes in burin manufacture is the absence of a standardized typological classification of burin types found in Neolithic assemblages. While some sortings appear to be oversimplified (e.g., Mortensen 1971: 29, which includes only three burin types), others are more elaborate, although none are satisfactorily defined. Syntheses of site reports dealing with burin types are therefore necessarily flawed, since one person's "double burin" is another's "mixed burin" type. The lack of such rigor became evident when I tried to reconstruct the burin "classes" I published in an earlier report (Rollefson 1988) based on the original data: the type definitions were simply too vague to provide repeatable results.

The situation demanded a new approach, and the fruits of that effort are presented in TABLE 1. Limited space prevents a definition for each type here, but the type-names are perhaps sufficient for the time being (see Rollefson n.d. for a more thorough description).

FIG. 1 displays the cumulative graphs of burin types at 'Ayn Ghazāl and how the popularity of burin types changed during the major phases of occupation. Clearly, there is a change through time from an emphasis on a "convex trajectory" in the MPPNB to an increasingly "diagonal trajectory" by the Yarmoukian period. But by itself, FIG. 1 is not explanatory, for all we see are the details of change, not the reasons for patterns of change.

Table 1. Burin typelist for analysis of combined 1983-89 burin samples from 'Ayn Ghazāl.

Group I. Simple Burins

1. Simple (no platform)
2. On break
3. Angle
4. Double simple
5. Double on break
6. Opposed simple-simple

Group II. Transverse Burins

7. Simple transverse
8. Transverse on a notch
9. Transverse on lateral retouch
10. Opposed simple-transverse
11. Opposed transverse-transverse

Group III. Dihedral Burins

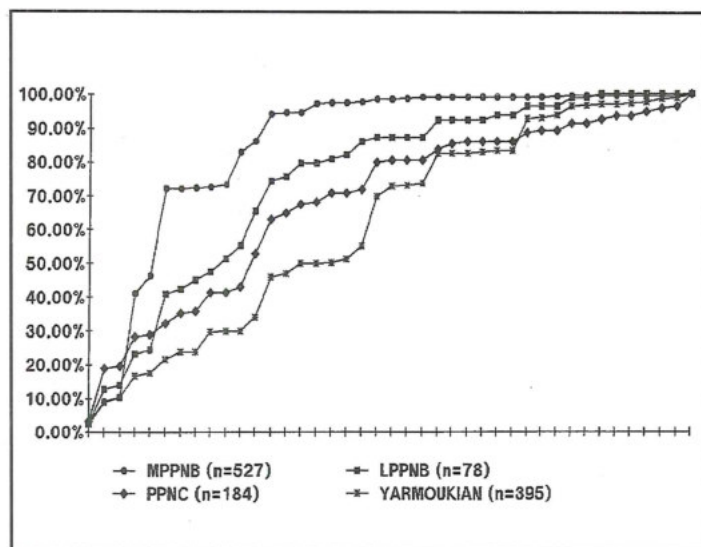
12. Straight dihedral
13. Canted dihedral
14. Opposed dihedral-dihedral
15. Opposed simple-dihedral
16. Opposed transverse-straight dihedral
17. Opposed transverse-canted dihedral

Group IV. Truncation Burins

18. Straight truncation
19. Oblique truncation
20. Concave truncation
21. Convex truncation
22. Double straight truncation
23. Double oblique truncation
24. Double concave truncation
25. Double convex truncation
26. Opposed straight-oblique truncation
27. Opposed straight-concave truncation
28. Opposed oblique-concave truncation
29. Opposed oblique-convex truncation
30. Opposed concave-concave truncation
31. Opposed concave-convex truncation

Group V. Mixed Truncation Burins

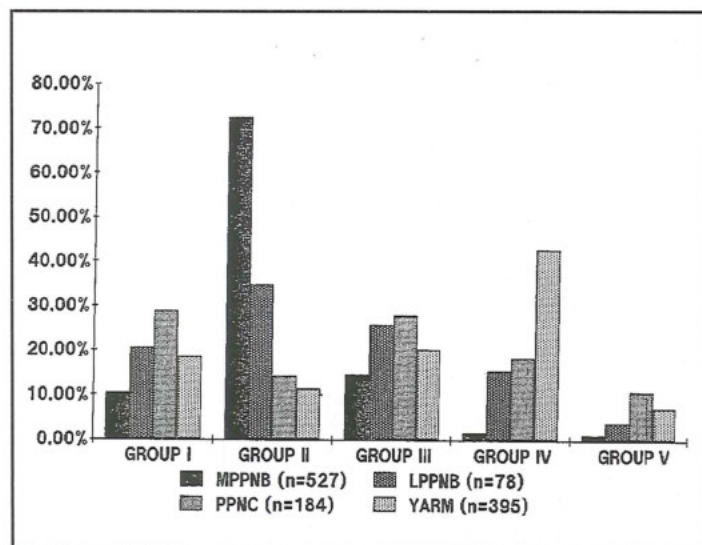
32. Opposed simple-oblique truncation
33. Opposed simple-concave truncation
34. Opposed simple-convex truncation
35. Opposed transverse-concave truncation
36. Opposed transverse-convex truncation
37. Opposed dihedral-straight truncation
38. Opposed dihedral-oblique truncation
39. Opposed dihedral-concave truncation
40. Opposed dihedral-convex truncation
41. Atypical/Other



1. Cumulative graphs of burin types from 'Ayn Ghazāl samples.

In essence, the 40 burin types (plus Type 41, "atypical, other") are unmanageable in terms of interpreting the trends of FIG. 1. Because of the technological basis of the burin typelist, the 40 types can be "collapsed" into four burin "groups" that reflect the technological emphases during the different phases (TABLE 1). FIG. 2 and TABLE 2 show that while there is considerable diversity in changes through time at 'Ayn Ghazāl, at least one major trend is evident: the overwhelming dominance of transverse burins (Group II) in the MPPNB decreases sharply, replaced to a great extent by an increasing production of truncation burins (Group IV).

There is another trend visible in FIG. 2 that is less striking, but one that still needs comment. The replacement of the transverse groups by the truncation group coexists with a pattern that is similar among simple burins (Group I) and dihedral burins (Group III). In



2. Comparison of Burin Group indices from the principal phases at 'Ayn Ghazāl.

these three burin groups, there is a steady increase from the MPPNB through the PPNC periods, although a sudden surge of Group IV (truncation) burins in the Yarmoukian breaks the otherwise consistent temporal trend.

Metric Variables

There are also consistent patterns of change in the absolute dimensions and ratios of measurements of the 'Ayn Ghazāl burins (TABLE 3). While burin length decreases steadily through time, thickness increases absolutely, with corresponding changes in the long section ($IL = Th/L$) and cross section ($IX = Th/W$). Based on 2-tailed t-tests, differences in mean length are statistically significant for all but the MPPNB:LPPNB comparison. For thickness variability, MPPNB samples are significantly different from all other samples, but the t-test results indicate that the other samples are possibly within the range of a single population. The strength of the change in length is shown by the IL changes: all means are significantly different from all others. Cross-section comparisons (IX) are also statistically meaningful except for the LPPNB:PPNC and PPNC:Yarmoukian tests.

Changes in width, although suggesting a general increase through time, are statistically significant only for MPPNB:PPNC and PPNC:Yarmoukian sample comparisons; the index of surface area ($IA = W/L$) matches the trend in width, and t-tests indicate that the MPPNB and LPPNB burin samples differ meaningfully from their PPNC and Yarmoukian counterparts, but not between themselves.

Interpreting the Trends

If "form (=group) equals function", then clearly the needs served by the various burin groups were changing, even radically, during the more than 2000 years of the occupation of 'Ayn Ghazāl. While specific uses of burin types are enigmatic in any event, the functions of the burin groups may be related generally to changes in environmental exploitation, which in turn may relate to changes in the ecological situations faced by the resident population at different times.

Based on the analysis of faunal remains (Köhler-Rollefson *et al.* 1988), there was an undeniable and continual degradation of the environment in the immediate vicinity of 'Ayn Ghazāl during its occupational history. The forest and woodland animal species so frequent in the MPPNB became scarcer during the LPPNB period, and they were absolutely rare by PPNC and Yarmoukian times. This ecological change corresponds with a decrease in transverse burins and a corresponding increase in the other four burin groups.

There is the untested suggestion, then, that the transverse burin group (II) may be related to the exploitation of wood and/or woodland-associated animal species. The

Table 2. Burin Group indices for the various cultural phases at 'Ayn Ghazāl.

Phase	Group I	Group II	Group III	Group IV
Yarmoukian	18.72	11.54	20.51	49.03
PPNC	29.94	14.69	28.82	26.55
LPPNB	20.51	34.62	25.64	11.54
MPPNB	10.89	74.92	12.54	1.65

Table 3. Mean dimensions (mm) and ratios of burins from the various cultural phases at 'Ayn Ghazāl.

Phase	L	W	Th	IL	IA	IX
Yarmoukian	38.33	19.55	8.60	0.148	0.544	0.464
PPNC	42.60	21.51	8.91	0.191	0.551	0.444
LPPNB	48.26	20.60	8.22	0.232	0.437	0.411
MPPNB	51.25	19.99	6.85	0.239	0.436	0.354

consistent increase of truncation burins (Group IV) mirrors a trend towards a growing dependence on more xeric resources, correlated with a general increase of simple (Group I) and dihedral (Group III); the dominance of truncation burins in the Yarmoukian and surface artifact collections at 'Ayn Ghazāl reflects close similarities with the "Desert Neolithic", for example (Rollefson 1988).

Changes in burin groups are paralleled by developments in metrics and metric ratios. The initially longer and more delicate burins of the MPPNB gradually give way to increasingly chunkier, sturdier tools by the Yarmoukian period, when cross- and long- sections are similar to generally contemporaneous "burin site" collections from the eastern deserts of Jordan (Rollefson 1988). This is strong support for the argument that burin-related activities at Yarmoukian 'Ayn Ghazāl were similar to those at the apparently transhumant sites in the steppe and desert. Placed in the opposite perspective, the burin sites of eastern Jordan are likely associated with pastoral nomadism in view of the strong correlations among burin types and evidence of the increased importance of pastoralism at 'Ayn Ghazāl (Rollefson and Simmons 1987; Köhler-Rollefson 1988; Simmons *et al.* 1988).

Changes in burin dimensions and metric ratios at 'Ayn Ghazāl represent more than changes in intended function, for the lithic technology employed by the residents of 'Ayn Ghazāl underwent considerable change from the end of the eighth millennium to the end of the sixth (Rollefson *et al.* 1992; Rollefson n.d.). The use of specially prepared blade cores characteristic of the MPPNB and LPPNB periods gave way to a new method that resulted in thicker blades and flakes (Rollefson n.d.). Why lithic manufacturing techniques changed so rad-

ically remains speculative, but the effects of the technological change were necessarily related to the shapes and sizes of tools that resulted.

The consistent change in "delicacy" vs. "robusticity" of burin types from the MPPNB through the Yarmoukian periods at 'Ayn Ghazāl reflect, we maintain, changes in *both* lithic technology and intended function. The absence or rarity of burins at ceramic Neolithic farming sites (e.g. Jericho and Tall Abū Thawwāb), on the one hand, and pastorally-oriented sites such as burin-rich Yarmoukian 'Ayn Ghazāl and the eastern desert "burin sites" on the other hand reflect major contrasts in the need for burins (especially truncation types) in the two separate kinds of subsistence economy.

Concluding Remarks

Ethnographic analogies to interpret the use of burins are rare and of questionable applicability to interpret the Levantine Neolithic archaeological record. Several recent edge-wear studies on burins have led to some degree of confusion (e.g. Moss 1983; Newcomer *et al.* 1986; Finlayson and Betts 1990). Simply put, there remains little in the way of direct or semi-direct evidence to judge the role of burins in the Neolithic tool kit.

It appears nevertheless that what the thin and relatively fragile burins of the MPPNB served gave way to demands of more rugged burin configurations through time, probably related to the gradual cultural degradation of the local environment. It is important to note that at 'Ayn Ghazāl simple (Group I) and transverse (Group II) burins always constituted important components of the burin inventory, even in the Yarmoukian period. One of the few ecological zones to be essentially undisturbed was the riverine vegetation bordering Wādī az-Zarqā'. It is possible, then, that simple and/or transverse burins

were used to process such plants as reeds for mats and basketry, materials useful to sedentary farmers and nomadic pastoralists alike.¹

But regardless of the "burin function" dilemma, the stratified burin assemblages from 'Ayn Ghazāl have shown a utility of the burin type/group description for general temporal ascriptions of lithic scatters encountered during surveys, enabling a more precise relative dating than simple "aceramic/ceramic Neolithic", and for discerning M/LPPNB and PPNC sites in the absence of other distinguishing criteria.

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¹ Indirect evidence of the importance of woven mats is especially rich at Jericho (e.g., Kenyon 1981: 271), and reeds were certainly abundant near 'Ayn as-Sultān in PPNB times (with high Burin Group II counts; cf. Rollefson n.d.). Reeds were also undoubtedly abundant during the PNA period at Jericho, but there is little evidence at all for reed use during that time, which coincides with an absence of simple/transverse burins. The use of reed mats/basketry is less certain at 'Ayn Ghazāl, but reed-impressed clay is relatively

common there during the MPPNB, and the use of reeds in fashioning the "skeletons" of the plaster statues from the site is well attested (Rollefson 1983; Rollefson and Simmons 1986). At Tall Abū Thawwib, the local landscape today suggests that reeds did not grow within the immediate vicinity of the site.