CHAPTER 10

PERSONHOOD AND THE LIFE CYCLE OF *SPONDYLUS* RINGS: AN EXAMPLE FROM LATE NEOLITHIC, GREECE

John C. Chapman, Bisserka I. Gaydarska, Evangelia Skafida & Stella Souvatzi

A detailed biographical analysis of the Spondylus *shell rings from the Late Neolithic settlement of Dimini, near the Bay of Volos, shows that many shells had a long and complex life history, with micro-statigraphically definable phases of erosion, burning, wear and fragmentation often present. These biographies form the basis of the rejection of Tsuneki's account of the shell ring assemblage as the rejects from failed production and, equally, Paul Halstead's account of competitive shell ring destruction as the basis for elite differentiation. A contextual analysis of shell ring discard showed a perplexing lack of fit between burnt house phases and burnt shell rings, as with unburnt house phases and unburnt rings. The re-fitting of 10 pairs of shell ring fragments, often from different contexts, shows the dynamic significance of broken shell rings in the constitution of personhood in this Late Neolithic community, where enchained relations using parts of objects cemented fundamental partible social relations. In conclusion, the study offers a comparison between the shell ring assemblage at Dimini and those from the Copper Age cemeteries of Durankulak and Varna on the Bulgarian Black Sea coast.*

Introduction

In this chapter, we offer a new interpretation of the much-discussed *Spondylus* ring fragments from Neolithic Dimini -one that applies fragmentation analysis in the attempt to understand more clearly the social biographies of individual rings, and thus to connect them with aspects of ritual, prestige, and social reproduction.

The interpretation of material culture has played a central role in the discipline of prehistory for over a century. While the importance of statistical approaches has varied during this period (Doran & Hodson 1975; Fletcher & Lock 1991; Shennan 1988), qualitative studies have remained at the forefront of prehistorians' approaches to things. The emergence of the "New Archaeology" and its consolidation into Processual Archaeology in the 1970s led to a wider range of analyses of things, not least with the use of models borrowed and adapted from anthropology. Thus, concepts such as "prestige goods" and social practices such as "potlatching" became available for use with prehistoric objects, even though their varied social contexts were not necessarily well matched in prehistory.

The morphing of post-processual archaeology into interpretative archaeology in the 1990s led to greater attention to objects not as markers of other social processes or even items on a check-list of traits, but as things-in-themselves, possessing their own significance and personal characteristics. One outgrowth of this approach was the biographical approach to objects, which combined the history of the technological production of a thing (the "*chaîne opératoire*") with a more socially grounded appreciation of the nature of the thing. One particularly fruitful process linking persons and things was Danny Miller's (1987) development of the Marxian notion of objectification, by which the essential characteristics of persons became objectified in the production of objects. An even more dynamic concept was that of "enchainment", by which persons were related to each other through gift exchange of objects that transmitted a human identity with the object (Strathern 1988). A similar approach to the personal values of things was described by Nancy Munn (1986) as the recursive development of fame by persons and things – shells could not become famous without the reputation of their "owners", while the owners could not develop their own fame without the shells on which that fame depended.

The net result of these biographical approaches to things was the breaking down of the person–object dichotomy that has long existed in archaeological practice. Recent research into material culture has begun to develop ways of inferring different aspects of personhood from artifact biographies (Chapman 2000; Chapman & Gaydarska 2006 ; Fowler 2004; Jones 2005). It is increasingly realized that insights into personhood –the socially grounded ways in which a person becomes her/himself– are vital for the interpretation of relations between persons and things in prehistory.

In their discussion of domestication, Jones and Richards (2003) have recognized the creative potential provided by social actions such as consumption and fragmentation. Rather than domestication arising out of a symbolic revolution represented by houses and villages, domestication was a set of novel relationships that occurred at different locales in the landscape –principally at villages composed of many houses. In another paper, Jones (2005: 216) recognizes households as relational identities just as much as persons. The vital role of fragmentation in these new relationships was considered to be the way it enabled elements of the material world that were hitherto discrete to be brought into metaphorical relationship –elements such as butchered and divided animal bones, the osseous remains of human ancestors and fragments and complete objects. For Jones and Richards (2003: 46), each animal

bone was enchained to all other bones of that animal and the anatomies of animals articulated with particular sets of human–animal relationships. While breaking and sharing established affiliations between actors, composite tools re-incorporated and re-articulated new sets of social relations (2003: 49). What Jones and Richards do not establish, however, is the ways in which fragmentation and enchainment are enacted in daily social practices.

This aspect of enchainment practices is discussed by Skourtopoulou (2006, n.d.) in her study of the lithic assemblage from the large open Late Neolithic settlement of Makriyalos, Northern Greece. Skourtopoulou (n.d.) sees artifacts as "material metaphors of inter-personal relations" at various socio-spatial scales. Enchainment, then, uses this metaphorical value of artifacts in order to objectify social relations, with different aspects symbolized at these various scales –personal relations as things and people move within and between households, economic and symbolic values for exotic exchange surpassing the communal scale and embedded in inter-cultural contact (2006). These insights are applied to intra-site lithic analysis in an attempt to extend social agency theory. They help us to see how enchainment works at the level of everyday practice by showing how an expedient quartzite flake is never only its material form but embodies production relations and personal skills that are rooted in settlement space. Although not explicitly mentioning enchainment, Hurcombe (2000) also emphasizes the gendered relations between persons involved in the different stages of any craft sequence –a position implying that often several people are enchained to any object at its birth, providing the basis for the metaphorical relations to which Skourtopoulou alludes.

The extension of this body of theory to parts of objects takes Strathern's (1988) original work on partible relations into new territory, since the Melanesian objects that enchain the people are invariably whole. However, as Gamble (2005: 89) has reminded us, fragmentation and enchainment are two different terms –the first relating to social action, the second to process. The Balkan prehistoric form of enchainment is based upon the fragmentation of the body and things, with each fragment standing for the whole (*synecdoche*), each whole potentially or actually part of a wider set of whole and partial objects and each set and each whole bearing the capacity for further subdivision. The overwhelming evidence that objects and bodies are treated in the same ways in respect of these three levels of completeness and in the course of their life histories (Chapman 2000) supports the notion that there is an interpenetration of persons and things that typifies fractal personhood in the Balkans and also, by extension, Greece. Thus any instance of deliberate fragmentation of objects (the social action) provides *prima facie* evidence for the process of enchainment, which, in the Balkans, frequently but not always, operates on the basis of fractal personhood (Chapman & Gaydarska 2006). Moreover, the comparison of the social value of shell rings and sherds –the former with an obvious and highly visible social value, the latter used in a different sort of enchainment, perhaps based upon the essential qualities of the clay or some historical or commemorative potential –leads to the question of how things made of different materials constructed different potentials for forming relationships. It is against the backdrop of these theoretical insights that we have written this study of a distinctive assemblage of shell rings.

Marine Shells and Shell Objects

There has been a recent upsurge of research interest in the archaeology of marine shells, with a Cambridge Manual devoted to the topic (Claassen 1998), a major survey article (Trubitt 2003), several articles on particular aspects of shell usage and now the current volume. There is thus a general recognition of the significance of marine shells, whether as material symbols of interpersonal relations, as symbolic links to water and the sea, with all of their metaphorical qualities, or as a sign of inland people's differential access to distant and rare goods (Claassen 1998: 203-208; Trubitt 2003). Trubitt (2003: 262-263) summarizes this research in her assertion that shell prestige goods are symbols of power and prestige associated with the exotic, to which Saunders (1999) and Glowacki (2005) would add the supernatural. Recent studies emphasizing the biographical approach to shell rings are summarized elsewhere (Chapman & Gaydarska 2006, in press b; Chapman *et al.* 2008). These and other ethnological studies provide a basis for the inter-penetration of the categories of shell ornaments and persons, just as shells can be persons in the Ojibwa under certain circumstances (Morris 1994: 9). It is important to emphasize the potential tension between two relations embodied in shells: on the one hand, the close material links between shells and persons and, on the other, the links between shells and aspects of Otherness such as the deep sea, the realm of the supernatural or simply the sea coasts that were remote for inland communities trading in shells. Clark (1991: 311) is surely right to question factors of scarcity and exchange value as **the** "explanation" of value in marine shells. It is important to account for the social value of shells **before** the development of a central role for shells in bridewealth and ceremonial exchange.

The study of shell rings has a long history in European Neolithic studies. In the Neolithic and Copper Age of the Balkans and Greece, two species of marine shell were frequently selected for the making of ornaments and for trade over a wide area of both South East and Central Europe –*Spondylus gaederopus* (the European spiny oyster) and the less common *Glycymeris glycymeris* (the dog cockle). Both are currently local to the Mediterranean, especially the Aegean and the Adriatic. Although fossil *Spondylus* was available in Central Europe (Shackleton & Elderfield 1990) and in eastern inland Bulgaria (Aneta Bakumska, pers. comm.), there is little evidence that it was of sufficiently high quality for ornament production. It is therefore accepted by most researchers that the distribution of many *Spondylus* shell ornaments found in the Linearbandkeramik indicates a long-distance exchange network –for Séfériadès, the first in Europe (Müller 1997; Séfériadès 2000, 2003; Chapman & Gaydarska, in press a).

The production of shell rings has been well studied by Tsuneki (1989) and Michelle Miller (2003), yielding a detailed *chaîne*

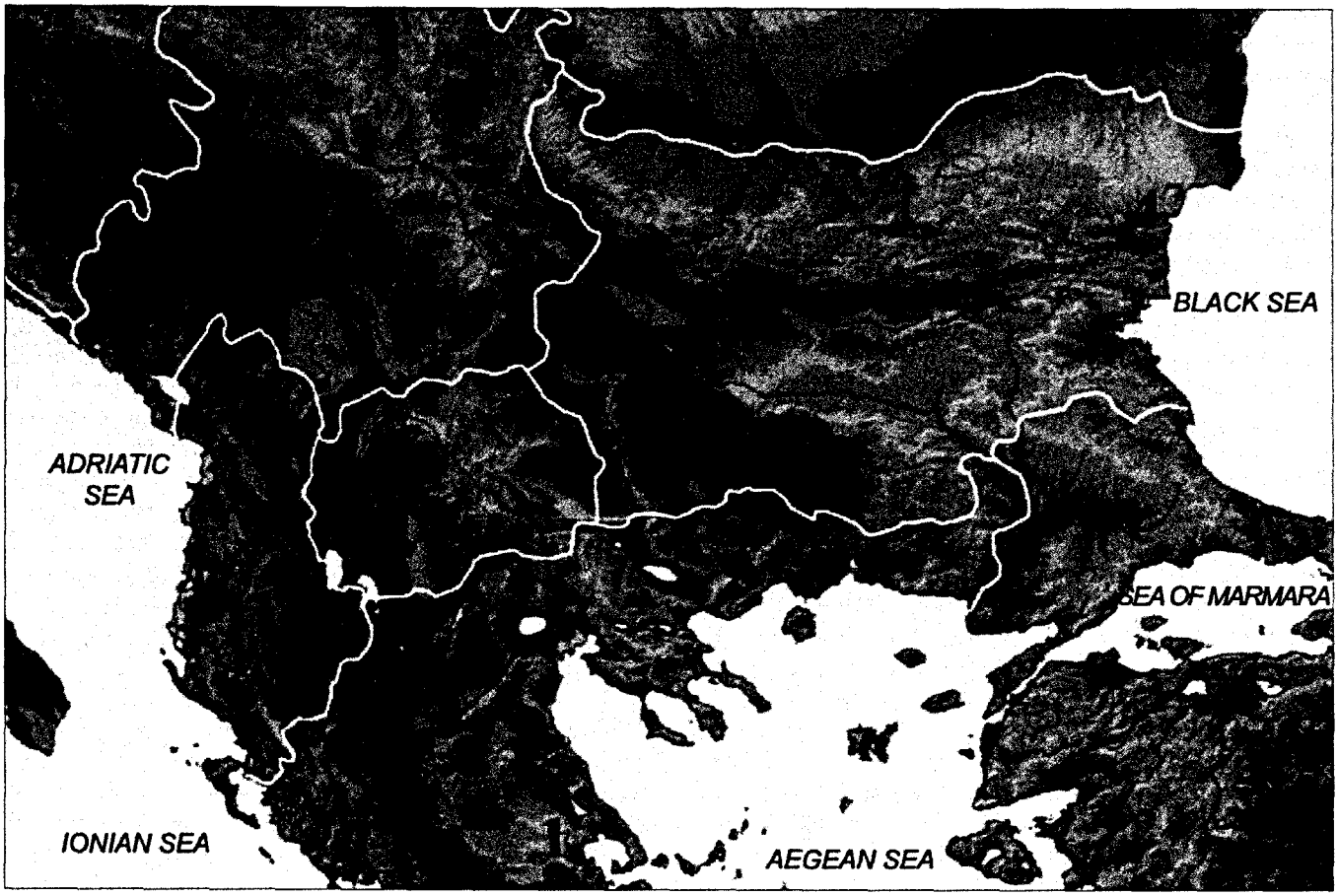


Figure 1. Location map of important sites mentioned in the text
1. Dimini; **2.** Ayia Sofia Magoula; **3.** Sitagroi; **4.** Varna cemetery; **5.** Durankulak cemetery

opératoire. What has been less clear is the symbolic processes constituting a vital part of shell ring making. Two processes have been identified: transformation and revelation. The first transformation comprises the change in state of the spiny oyster from an irregular, thorny, dull and asymmetrical **natural** thing into a finely polished, symmetrical, highly colored **cultural** object with a perfect surface. As the shell is ground down towards its final form, each grinding reveals a new combination of colors and surface features. It is this revelation of pre-existing features through a continuing process of grinding that gives the making of shell rings such a metaphorical potency. This means that the making of shell rings is a very personal statement, beginning with the diver who recovered the raw shell from the its rocky underwater home, to the final decision to stop grinding in order to select a specific pattern of natural features. Each stage in the process was linked to an individual or individuals, whose identity was linked, through enchainment, to the shell ring as un-finished biography.

THE LOCAL AND THE INTER-REGIONAL PROBLEMATIC

The study of the *Spondylus* shell assemblage from Dimini was undertaken to answer a research question derived from re-fitting studies of Balkan Neolithic and Copper Age shell rings and figurines and to seek to shed light on the conflicting interpretation of the Dimini shell rings (Tsuneki 1989; Halstead 1993, 1995; Kyparissi-Apostolika 2001; Souvatzi 2000, 2008). The first question arose out of fragmentation and re-fitting studies pursued to provide a methodology for the fragmentation premise –the notion that deliberate fragmentation of objects was practised and that broken objects continue their use-life "after the break". The shell of a freshly collected *Spondylus gaederopus* bivalve has a hardness of 7 on the Moh's scale, comprising a dense, tough but light material. The availability of fresh, modern *Spondylus* shells in the somewhat polluted Aegean and Mediterranean waters has prevented us from carrying out experimental work on shell ring making and breaking – not a research task willingly supported by many museum curators! But all fragmentation experiments conducted with fired clay objects show that the lighter the object, the harder it is to be broken accidentally through dropping on hard surfaces (unpublished experiments, Vădastra, Romania: J. Chapman, D. Gheorghiu and S. Priestman). It is for these reasons that we maintain that many of the broken shell rings have been deliberately fragmented –in this case, there are very few viable alternatives to breaking such a hard, light material! There are two additional forms of evidence in support of the notion of deliberate breakage: first, when re-fitting studies show that fragments from the same object had been deposited far from each other; and secondly, when the various fragments from the same object had different biographies after the breakage.

The specific research question that led us to Dimini revolved around the absence of inter-grave re-fits of shell rings at the

Durankulak and Varna cemeteries in comparison with the frequent re-fits between fired clay figurines from different settlement contexts at the Dolnoslav tell (Chapman & Gaydarska 2006). Was the discrepancy in intra-site re-fits connected to the material –fired clay *vs.* shell– or was it related instead to the context of discard –domestic *vs.* mortuary? For this reason, it became essential to find a sizeable assemblage of *Spondylus* rings from a totally or nearly totally excavated settlement. No such settlement existed in the Balkans but one candidate emerged from Northern Greece –the Late Neolithic settlement of Dimini, where almost 100 shell rings had been recovered in three separate excavations, dating from 1901 (Stais), 1903 (Tsountas 1908) and 1974-6 (Hourmouziadis 1979).

The site of Dimini is situated 5km west of the modern city of Volos and 3km from the present coastline (**Fig. 1**). It lies on a low rocky spur at 16masl and covers an area of 10,000sq.m.

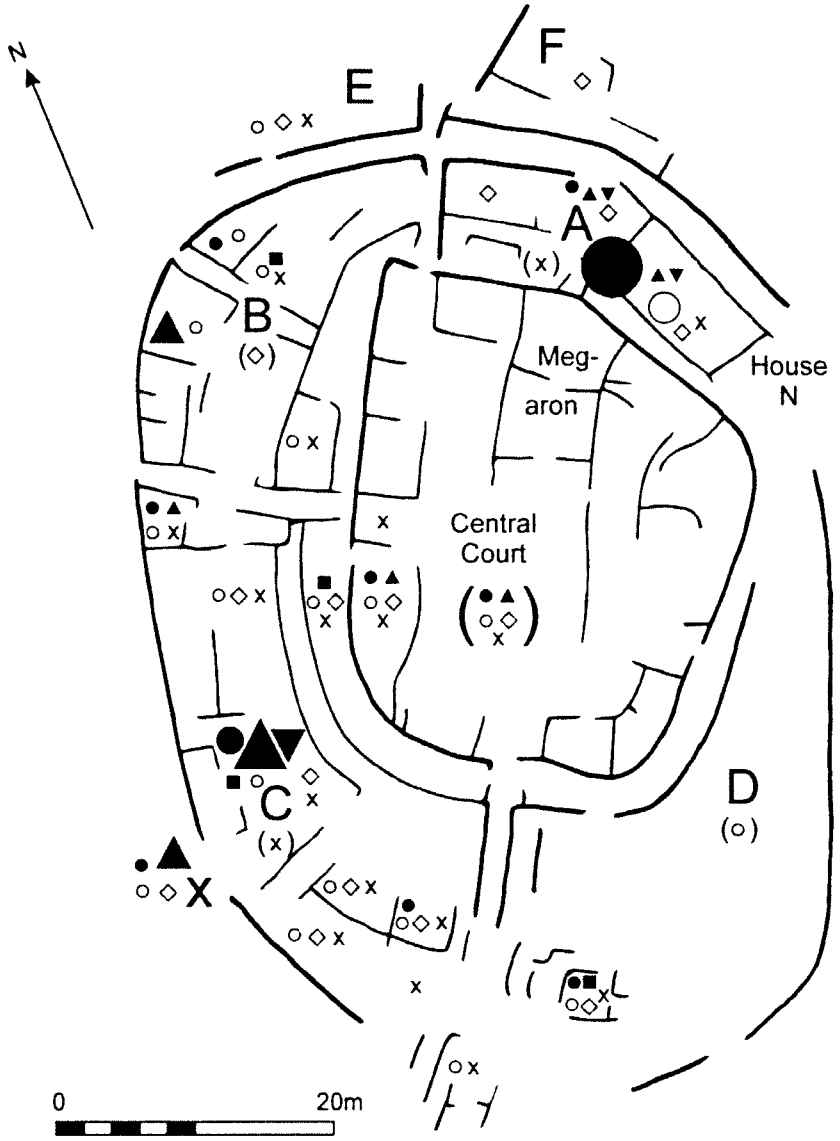
The Late Neolithic settlement (4800–4500 BC, based on four AMS dates obtained from burnt material collected from the settlement in 2004: Skafida, in prep.) is composed of habitation terraces defined by six or seven stone-built enclosures that generally follow the natural contour of the hill and surrounding a central courtyard (**Fig. 2**). The sixth and seventh walls, identified by Tsountas (1908), are not preserved today. The Dimini hill was continuously used throughout the Bronze Age, although sparsely and mostly not as a settlement but as a burial ground (Adrimi-Sismani 1993, 2002; Maran 1992: 217-218; Tsountas 1908: 125-132, 248-252). With the exception of the southeast part, which remains unexcavated, the greater part of the mound –perhaps 75-80%– has been excavated (Dimini Excavation Archive; Hourmouziadis 1979).

Tsountas' perception of the enclosures as high fortification walls (1908: 59) was influenced by the picture of the Homeric city coming to light in the contemporary discoveries of Mycenae and Troy, leading to his interpretation of Dimini as a well-defended settlement, an "acropolis", ruled by a king residing in the tripartite building of the first enclosure. Hourmouziadis (1978a, 1979) convincingly rejected the defensive function of the enclosures, viewing the settlement as being functionally divided into large spatial segments (named "Domestic Activity Areas" [Hourmouziadis 1979; English term by Elia 1982: 308]), each of which contained entirely self-sufficient and uniform social units that corresponded to one household or family. Nonetheless, Hourmouziadis also emphasized the collective identity of the Dimini community, while disputing the existence of a social elite on the site. By contrast, Halstead (1984, 1995) argued that the central courtyard and the larger building there, interpreted as a "megaron", represents social ranking, an institutionalized "elite" deriving its power from its success in agriculture and its ability to control surplus appropriation or redistribution and to maintain order in times of conflict and dissent, although his study of the animal bones from the site (Halstead 1992) did not yield evidence for socio-economic differences. Halstead's views of Dimini are part of his general model of social differentiation (Halstead 1989, 1995), according to which short-term attempts to stabilize food production led to long-term emergence of institutionalized elites in the Late Neolithic, named "central megaron elites" for Thessaly, and of social stratification in the ensuing Bronze Age.

More recent research by Souvatzi (2000, 2007a, 2008) used the intra-site patterning of the evidence and the small-scale of everyday practices to call all these models into question. Combined analysis of the pottery, Hourmouziadis' excavation archive (with its insights into recovery biases), the architectural data and features, and a reconsideration of the small find distributions (see Souvatzi 2008 for details and references) suggested considerable variation, rather than uniformity, in the organization of individual social units, the existence of craft specialization and division of labour in different production processes, as well as interdependence rather than self-sufficiency within the village. Nonetheless, there is no consistent evidence for a hierarchical social structure, much less for a "central megaron elite" formed on economic considerations and holding power over others (see Souvatzi 2007b and Souvatzi & Skafida 2003). Indeed, field observations, excavation diaries and even Tsountas' (1908) plan of the site indicate that the central megaron dates to the Bronze Age.

The interpretation of the shell rings at Dimini has formed part of an ongoing and wider debate about the nature of Late Neolithic society at Dimini and in Thessaly overall. All participants to the debate agree that the site of Dimini was on or near the prehistoric coastline, even if the dating of past coastline changes remains insecure (Zangger 1991). By contrast, several interpretations have been proposed for the large number of broken *Spondylus* rings at Dimini (**Fig. 2**). The third excavator –Hourmouziadis (1979)– did not recognise any evidence for craft specialization at Dimini, except with regard to incised pottery (Hourmouziadis 1978b), but favoured the idea that each Domestic Activity Area produced its own food, tools and shell rings. To the contrary, Tsuneki (1989) maintained that the high frequency of shell pre-forms and half-finished pieces indicated specialized on-site making of rings, especially likely in House N, and beads and buttons, especially in Area R, arguing that the rings were broken in the final stages of manufacture.

The large number of fragments suggested to him a large-scale production, mostly for export to inland Thessaly and perhaps the Balkans. In his reconsideration of Tsuneki's published data, Halstead (1993, 1995) agreed with Tsuneki that the two main *Spondylus* concentrations were not produced by sampling bias but noted that ring-making débitage was widespread in many parts of the site (1993: fig. 2). Thus the concentrations were produced after manufacture, for, as Halstead (1993: 606) notes: "*there is no reason to doubt that most of the shell ring fragments found at Dimini derived from finished objects*". Halstead focused on the high frequency of burnt ring fragments, suggesting that they were "*not burnt with other discarded objects in the course of normal refuse disposal but were deliberately destroyed by fire*" (1993: 608), as one form of inter-household competition (1995: 18). This potlatching behavior allegedly countered the inflationary tendency inherent in wealth accumulation and allowed the conversion



	1-5	6-10	>10 pieces
finished rings	●	●	●
finished buttons	▲	▲	▲
finished cylinder beads	▼	▼	
other finished pieces	■		
unfinished rings and manufacturing waste	○	○	
manufacturing waste from small objects	◇		
indeterminate worked *Spondylus* shell	x	X	
provenience approximate	( )		
domestic areas A-F	A-F		

Figure 2. Plan of Late Neolithic settlement of Dimini, with concentrations of *Spondylus* rings [after Halstead 1993: Fig. 2]

of wealth to prestige. Hence, for Halstead, unequal access to *Spondylus* was one basis for the emergence of social inequality in Late Neolithic Thessaly, accompanied as it was by the emergence of hoarding from sharing.

In her study of prehistoric ornaments from Thessaly, Kyparissi-Apostolika (2001) supports Tsuneki's arguments that the production of *Spondylus* items was specialized and that Dimini was a major production center in Greece but disagrees with his suggestion that these items were intended for export mostly to inland Thessaly. Comparative study of the shell assemblages from inland Thessalian sites such as Ayia Sofia and Platia Magoula Zarkou showed that they deposited considerably lower amounts of shell items and, apparently, limited access to shells and production skills. Accordingly, Kyparissi-Apostolika (2001) suggests that the production of *Spondylus* items at Dimini was intended for export primarily, if not exclusively, to southeast and central Europe. She generally supports the ascription of prestige to *Spondylus* items, particularly rings, and argues that Dimini enjoyed a special and privileged position in long-distance exchange networks.

Halstead's version of a prestige goods economy, underpinned in part by shell rings, is criticized by Souvatzi (2007b, 2008: 151-152, 157), who questions the evidence for shell rings denoting intra-site prestige and proposes instead that craft as well as other goods seem to have acted as symbols of social integration and of collective rather than individual prestige, given the fairly even distribution of all types of material in the various households (Souvatzi 2008: 127-134). Building on her standardization of the terminology for the site through her useful definitions of the terms "House" and "Open Area", Souvatzi accepts Tsuneki's notion of specialized shell object production, arguing that two phases in the life of House N possessed all stages in the shell ring *chaîne opératoire*, while Area R showed all the characteristics of a multi-functional workshop, including not only high quantities of *Spondylus* shell buttons and beads, but also a concentration of 70% of all of the incised pottery, together with a potter's firing feature and other equipment (Souvatzi 2008: 141-144), as well as an exclusive representation of all stages of the chipped stone production sequence (Karimali 1994: 345-347). Wealth accumulation could not have occurred in workshops and open areas. Souvatzi's interpretation that the shell rings in House N were burnt in the course of the burning of the house is supported by the claim that other organic remains were also burnt there –a claim directly contradicted by Halstead (1993: 608), who found unburnt animal bones in this house.

What can a re-study of the *Spondylus* shell rings from Dimini add to the already existing welter of opinion and counter-opinion? Is it possible to shed new light on shell ring discard through a study of ring biographies and fragmentation? The consequence of this varied problematic is the formulation of a complex set of five aims in this study:

- A consideration of recovery techniques, deposition, re-deposition and post-depositional processes at the Dimini site
- A description of the shell objects at time of deposition (including their completeness, size and the extent of burning)
- the existence of any cases in which the shell fragments re-fit with each other from different contexts of deposition
- the biography of each shell object, from manufacture to deposition, based upon careful study of the condition of the objects.
- A re-evaluation, from the fragmentation standpoint, of the Tsuneki, Halstead, Kyparissi-Apostolika and Souvatzi hypotheses over the shell ornaments

The Analysis of the Dimini *Spondylus* Assemblage

Site formation processes

The Late Neolithic shell assemblage at Dimini comprises almost 5,800 examples, with both unworked shells and worked shells in large quantities, representing over 20 species of marine shells. This assemblage includes over 500 pieces of *Spondylus gaederopus*, over 400 from the Hourmouziadis excavations and 100 from other excavations. Focusing on the Hourmouziadis finds, Tsuneki counted 243 broken or complete shell objects and 161 worked or natural shells. The objects comprised 87 rings, 141 buttons, 8 cylindrical beads and five miscellaneous objects. The inclusion of *Spondylus* rings found in the earlier excavations brings the total of rings to 96. While all but one of the rings was broken, most of the buttons and beads were complete. On the basis of the fragments of partly worked shell rings, Tsuneki concluded that *Spondylus* rings were produced on site (Tsuneki 1989). The condition of the rings is variable, indicating many different stages in the *biography* of the objects (**Fig. 3-7**).

The earlier excavations are similar to those of Hourmouziadis in one respect –there was no formal policy of sieving or flotation of sediments. Thus, we cannot exclude the possibility that a proportion of small to very small objects was not recovered from the excavations. Nonetheless, the trowelling and hand-excavation carried out on the Hourmouziadis excavation produced a higher standard of recovery than on the earlier excavations. Two factors would have improved the recovery rate of *Spondylus* rings: (1) the ring colors, whether unburnt white or burnt black, formed a contrast to the prevalent brown soils and fills of the settlement, improving recognition in trench excavation; and (2) the "value" attributed by the excavators to *Spondylus* finds would have been transferred to the excavators by positive feedback after discoveries of shell rings, buttons or beads –all object types that were meaningful to the village workforce. The successful operation of both these factors can be demonstrated by the large number of small shell objects found at Dimini, which included 141 buttons ca. 10mm in diameter and some even smaller beads. The maximum size of fully 85% of the measurable *Spondylus* ring fragments was smaller than 15mm. Unless the missing parts of the rings whose fragments were discovered at Dimini were in turn fragmented into smaller fragments, it is the larger portions of the rings that have not been found in the excavations. While not

Figure 3. Museum Inv. No. 354: unburnt white surface polished over fine arcaded lines, with later deposit

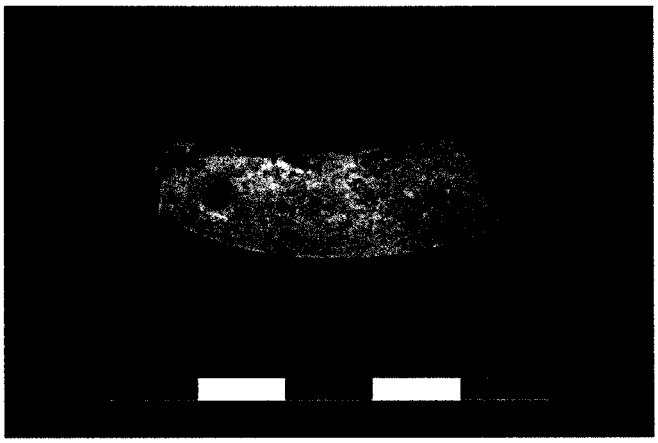


Figure 4. Museum Inv. No. 521: unburnt natural lines and garlands, later perforated with a sculpted perforation and still later overlain with deposit

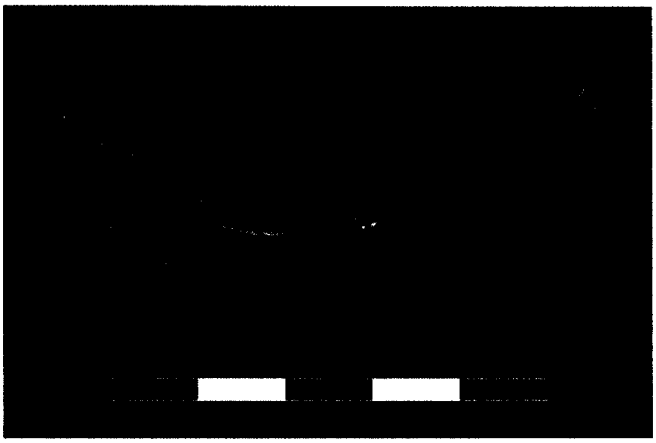


Figure 5. Museum Inv. No. 331: heavily burnt surface, with natural notch; one break unburnt (viz. broken after burning) and the other break burnt (viz., broken before burning)

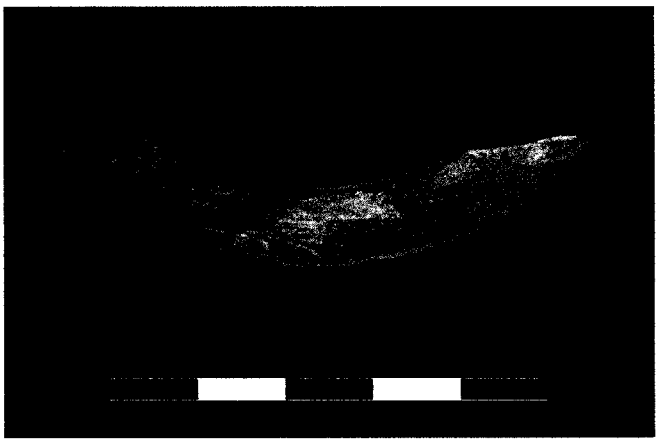


Figure 6. Museum Inv. No. 320.1: different degrees of burning over natural lines and pitting; one unburnt break; flake detached after burning

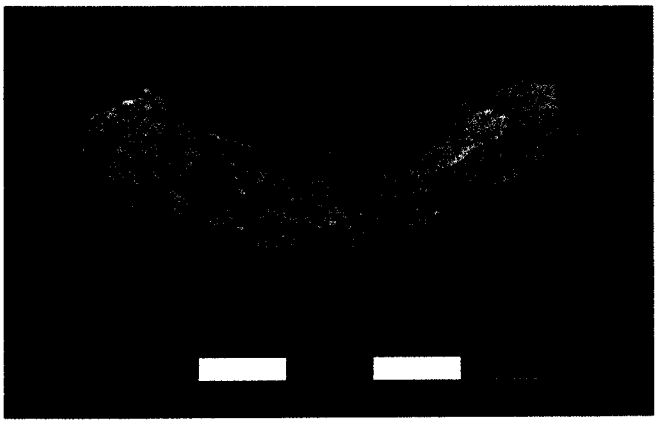


Figure 7. Museum Inv. No. 355.1: lustrous surface; strongly burnt and heavily pitted - the most worn and battered example in the assemblage

claiming complete recovery of shell objects, there is a reasonable case to be made that the majority –perhaps the vast majority (?)– of shell ring fragments in the excavations have been recovered for this study.

However, it is correct to state that a proportion of the Dimini deposits remain unexplored –perhaps 15-20 percent. For example, the South-East part outside the innermost enclosure (Hourmouziadis' Domestic Area D) is largely unexcavated. Findings outside of the mound (Hourmouziadis 1979: 51) suggest that habitation may have extended outside the enclosures, although its extent and nature are not known. Recent excavations by the 13th Ephorate of Prehistoric and Classical Antiquities of Volos for rescue and restoration purposes have encountered Late Neolithic deposits to the East and South of the mound, right outside of what is today the outermost enclosure (Adrimi-Sismani 2000: 279, fig. 1, 2002: 95, 2003: 71; for a geophysical survey of this area, see Sarris *et al.* 2002).

The finds contexts of the shell rings is indicated below (**Table 1**). This shows that the assemblage is dominated by deposition in one single house (N), with a smaller concentration of ring fragments in one Unroofed Area (R). To the extent that settlement deposition tends to be dominated by open (yard) or semi-open (pit) rather than closed (burnt house) contexts, a quarter of the Dimini shell ring fragments of known context (n = 82) derive from open contexts, with uncertainty about whether they were in their locus of primary deposition, moved from any primary place of deposition or re-deposited deliberately. While accidental movement of objects over distances greater than a few meters is harder to imagine, given the prolifera-

tion of drystone wall barriers on the site, children's play is but one common way of moving objects, especially bright shiny objects like shell ring fragments (for others, see Hayden & Cannon 1983). The greater closure of the finds contexts for the remainder of the fragments suggests a consistent deposition in primary context rather than secondary movement. Moreover, the discovery of concentrations of fragments suggests that this is not accidental behavior but deliberate depositional choice, given also that several spatial contexts were found burnt and/or sealed by superstructure collapse, which increases the chance that the deposits discovered underneath were intact (Souvatzi

Excavation Context	Number of Shell Rings / Ring Fragments
Central Yard	2
House X	3
House N	46
Megaron B	1
Sector 4	3
Sector 10	5
Sector 12	1
Sector D	4
Sector H	1
Sector K	3
Unroofed Area R	13
Surface	3
Unknown	11

Table 1. Finds contexts of *Spondylus* rings, Dimini

2008: Table 5.1). Within the houses and the unroofed area, there is a strong association between *Spondylus* rings and the vicinity of hearths. The main exceptions to this association comes from the second phase of House N, where a group of 19 shell rings was kept in a built-in stone cupboard and a small group of three rings was stored on a stone shelf, although, in an earlier phase of the same house, shell rings occurred typically near hearths. House N is interesting also in that it shows uniform relative quantities of waste and of finished products, as well as being the only space where all the stages of the ring production sequence are represented (Tsuneki 1989: 13). This strengthens further the impression of primary deposition as well as the suggestion discussed above that the production of rings took place, partly or mostly, inside House N (Souvatzi 2008; Tsuneki 1989).

All of these factors lead to the conclusion that there were two kinds of discard and deposition of shell ring fragments at Dimini – deliberate deposition in more closed contexts (the houses and unroofed Area R) (n = 63) and less structured discard in open contexts, which it is hard to characterize as undisturbed primary contexts (n = 19). There is no context recorded for the remaining 14 ring fragments. This division into more and less closed contexts provides an analytical framework to identify similarities and differences between groups of ring fragments. The potentially biasing effect of the large group from House N has been borne in mind throughout these analyses.

The condition of the shell rings

The first point about the Dimini shell ring assemblage as a whole is its high rate of fragmentation. The shells are much more incomplete than those in the mortuary groups from Durankulak and Varna. While one-quarter of the Varna cemetery shell rings are complete, there is only one complete ring at Dimini. A Completeness Index –the index of the completeness of deposited objects (Schiffer 1987)– shows a similar percentage of rings with an Index of 20-40% to that of Varna but with fewer of the smallest fragments (10-20%) than at Varna (**Fig. 8**). The principal difference is the paucity of large fragments (> 50%) at Dimini, indicating not necessarily that fragmentation has been much more intense at Dimini (since many small fragments were re-fitted in Varna graves to make complete or large fragments) but that the settlement context was not a context for accumulation of re-fittable fragments. Since the Completeness Indices of the Dimini settlement and the Varna cemetery are complementary distributions, a hypothetical Dimini cemetery would perhaps contain the large shell ring fragments that are missing from the Dimini settlement. In this sense, the Dimini settlement may have differed from Balkan Copper Age sites with extensive series of burnt house depositional contexts, such as at Dolnoslav (Gaydarska *et al.* 2007).

A second characteristic of the Dimini shell rings is their small size, as measured by the inner diameter. Within a total range of 12-73mm, 80% of the ring diameters peak between 20-39mm (so-called Medium size), with similar proportions of Small and Large fragments (**Fig. 9**). This means that only one in ten shell rings could have been worn as bracelets when complete, with the others sewn to clothing, tied round the neck or arm or placed on the figurine shelf along the long walls of houses, as in House N. All contexts but one are dominated by Medium-sized rings, the exception being Unroofed Area R, with the highest proportion of Large and Small ring fragments.

The third and very visual characteristic of the Dimini shell rings is burning –a point made by all other commentators. Almost two-thirds (64%) of the shell rings had been burnt but to different strengths and over different areas of the ring surfaces (e.g. **Fig. 5-7**). Three grades of burning have been defined: "slight" (occasional traces of burning leaving a grey color); "medium" (up to 50% of the ring surface being burnt, with colors ranging from grey to black); and "strong" (over 80% of the ring surface burnt to a dark grey or black color). It is important to note that burnt rings were **not** discarded in most contexts but only in three structures and the burnt layer of one open context (Sector D). There are several discrepancies between the nature of the depositional context –whether burnt or unburnt– and the condition of the rings –burnt or unburnt. Several burnt *Spondylus* rings, as well as some unburnt exam-

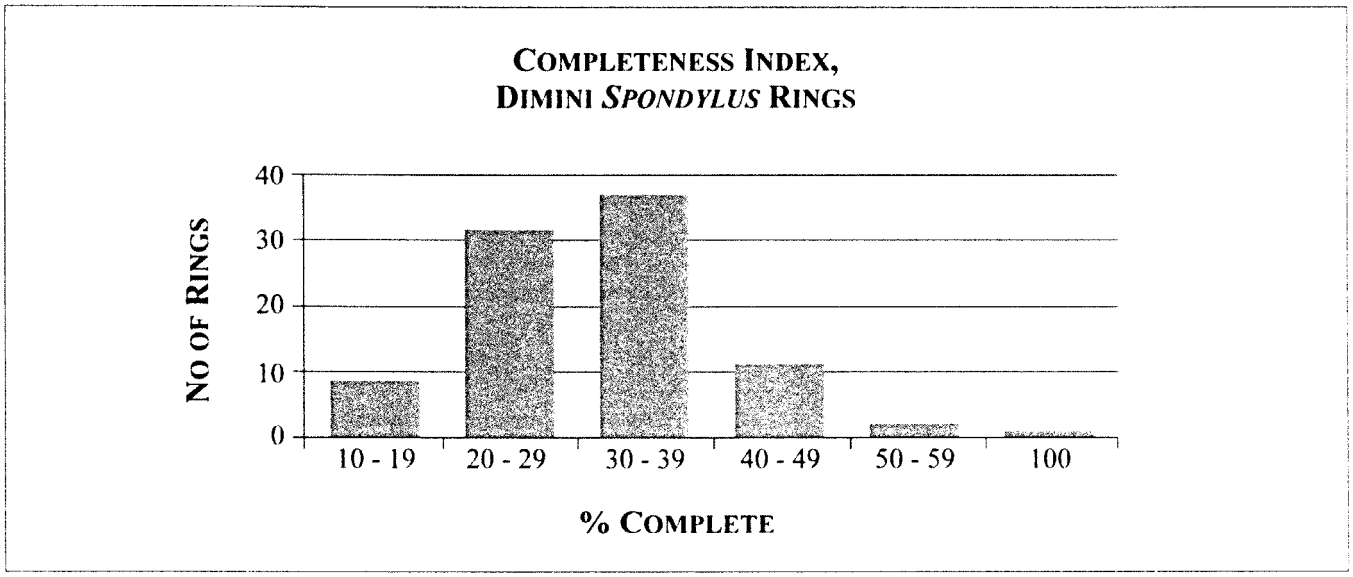


Figure 8. Completeness Index, Dimini shell rings

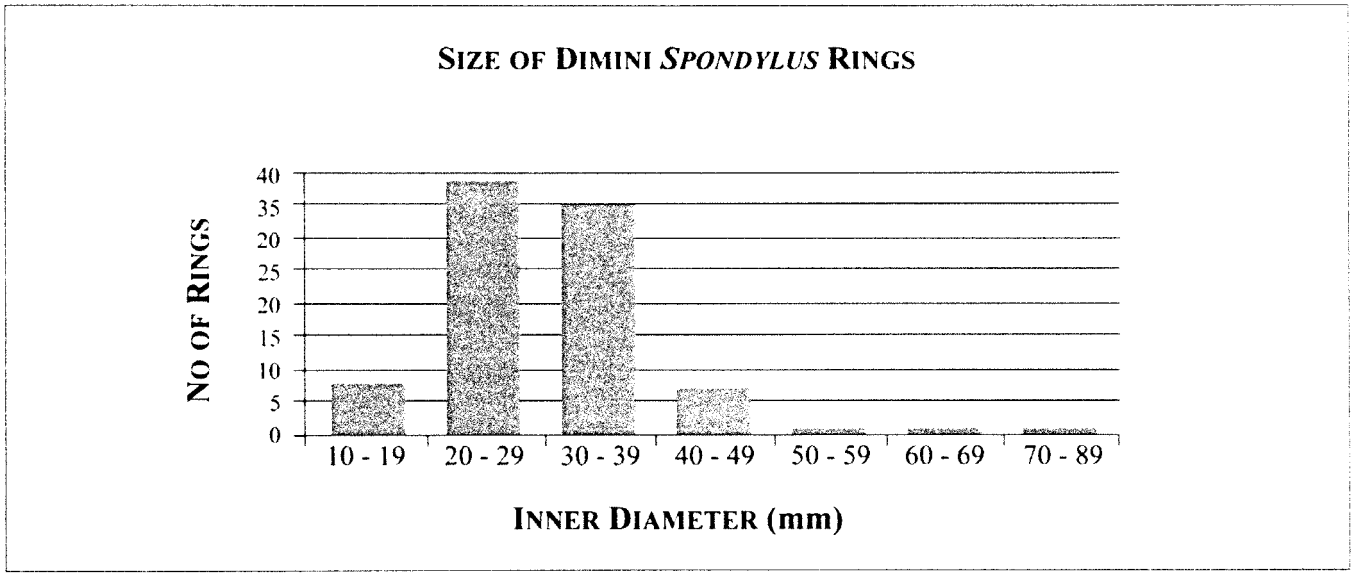


Figure 9. Ring size, Dimini shell rings

ples, were deposited in unburnt contexts in Phase 1 of House N, while some unburnt shell rings, as well as burnt examples, were deposited in the burnt Phases 2 and 3 of House N (Souvatzi 2000: 128, 2008: 151-152, Table 5.1). While House X was burnt at the end of its life, two unburnt rings were deposited there but only one burnt ring. A similar combination of burnt and unburnt rings was deposited in the burnt clay zone of Area D. Only in the burnt clay layer in Structure R did a large group of burnt rings occur –four slightly, one medium and four strongly burnt rings– but even there three unburnt rings were deposited. This pattern of discard can convincingly be explained neither by accidental burning of rings lying close to fireplaces nor by chance discard, since, otherwise, more burnt rings would have been found in the open contexts. This suggests that, *contra* Halstead (1993) and Souvatzi (2008), it is improbable that all of the shell rings were burnt *in situ* in the course of a house fire; rather, there has been a deliberate selection of a wide range of rings –some burnt, some unburnt– for discard in Houses N and X and the Unroofed Area R. We shall return to the implications of this finding when we look at individual ring biographies (see below, pp. 149-151).

In summary, the Dimini shell ring assemblage was characterized by highly fragmented, small and frequently burnt objects. While there is greater variability on the larger fragment groups, this feature does not explain the differences in the types of ring fragments discarded in the various kinds of contexts.

The re-fitting study

The high rate of fragmentation of the Dimini shell ring assemblage suggested the value of a re-fitting exercise, in which every available fragment (n = 93: 3 fragments were on permanent display in the Archaeological Museum, Volos) was tested for matches against every other fragment. This study would give an idea of the extent of enchained relations across

the site, as well as helping in a first estimate of the proportion of "orphan ring fragments" (viz., fragments from rings whose other portions have not been found on site). At this point, we should be reminded that the site has not yet been completely excavated (see above, p. 142; Skafida, in prep.). Thus, this study cannot define the status of "orphan ring fragments" with any certainty but can provide a snapshot, in 2005, of the state of the shell ring assemblage.

The results of the re-fitting exercise showed one physical re-fit between two fragments and varying probabilities of nine further pairs deriving from the same shell ring. Bollong's (1994) criteria for sherd re-fits have been adopted to the case of shell rings, using five measures of ring fragment similarity: (1) color; (2) inner diameter; (3) special natural features; (4) polish; and (5) thickness/width. In this manner, we could make realistic estimates of the likelihood of fragments deriving from the same ring, despite the absence of a physical re-fit. Careful observation of each potential pair of re-fitted fragments allow us to state that the postulated pairs share a higher probability of deriving from the same object than all other potential pairs. The single physical re-fit and the nine postulated re-fits are listed below (**Table 2**).

The probability of successful re-matching is also related to the size of the shell ring assemblage. In large assemblages of over 1,000 rings, such probabilities are much lower than in the case of an assemblage of fewer than 100 pieces. Moreover, most of the postulated re-fits share the characteristic that a small fragment of missing ring separated the two fragments. It seems possible that this missing part was the débitage of shell ring breakage and that it was missed in the 1970s excavations. By contrast, such small pieces have been found in several graves in the Varna cemetery, suggesting "local" breakage of shell rings at the graveside.

If all of these re-fits are accepted, two obvious inferences can be drawn. First, the re-fitting of the shell ring fragments has managed to join 21.5% of all the fragments –a higher proportion than has ever been achieved with fired clay figurine re-fitting (Gaydarska *et al.* 2007) or with inter-grave shell ring re-fitting (Chapman & Gaydarska 2006). Secondly, this still leaves a potential 73 "orphan ring fragments" incomplete and without any re-fits within the excavated deposits. Given the unknown proportion of the site as unexcavated, with the high probability of foundation deposits in the lower parts of the stratigraphy, it would be unwise to underline the certainty of "orphan ring fragments" linking up with other fragments off the site, although this practice can be documented for figurines at Dolnoslav and is equally likely with the Dimini shell rings. But what is the Completeness Index of the re-fitted rings?

Our Re-Fit No	Fragment 1 Inv. No/ Context	Fragment 2 Inv. No/ Context	Shared Criteria	Probalitiy
1	O 312 / House N	O 315/ House N	physical fit	100%
2	O 444/ Str. R	O 446/ Str. R	1/2/3/3/4/5	90%
3	BE 908.2/ surface	O 344/ Central Yard	1/2/3/4	80%
4	O 561.4/ ???	O 561.5/ ???	1/2/4/5	80%
5	O 325/ House N	O 327/ Area H	1/2/3/4/5	70%
6	O 561.10/ ???	O 320.6/ House N	1/2/3/4	60%
7	O 353/ Central Yard	O 546/ Area 10	1/3/4/5	60%
8	O 488/ Area 10	O 510/ Area 4	1/2/3/4/5	60%
9	O 477/ Str. R	O 468/ Str. R	1/3/4	50%
10	O 474.1/ Str. R	O 474.2/ Str. R	1/2/3	50%

Table 2. Physical and postulated re-fits between pairs of shell ring fragments, Late Neolithic Dimini
Key:- Str. – Structure; the shared criteria are defined in the text in the paragraph before Table 1

In each and every case, the re-fitted rings stubbornly constitute a still incomplete shell ring, with the missing part(s) ranging from 10% to 60% (**Fig. 10**). There is a modal tendency for fragments to cluster around 30-40%, perhaps indicating a ring division into three broadly equal parts. Thus, even with actual and highly probable ring fragment re-fits, there are still many missing parts!

The spatial scale of the shell ring re-fitting within Dimini shows considerable variability (**Fig. 11**). Four of the re-fitted pairs were discarded in the same context (Re-fits 1, 2, 9 and 10). Two re-fits were discarded in different sectors: one part of Re-fit 7 was discarded in Sector A in the Central Yard, the other in Area 10 –a minimum distance of 270m (maximum of 380m) along the outside of enclosure wall 3, along the radial entrance passageway to the Central Yard and across two more spaces in the Yard. The different parts of Re-fit 8 were discarded in Areas 10 and 4 –a minimum of 130m apart (maximum of 220m) across two or three open areas. One re-fit (Re-fit 5) links a House and an Area –House N and Area H, a minimum of 100m apart (maximum of 180m) and separated

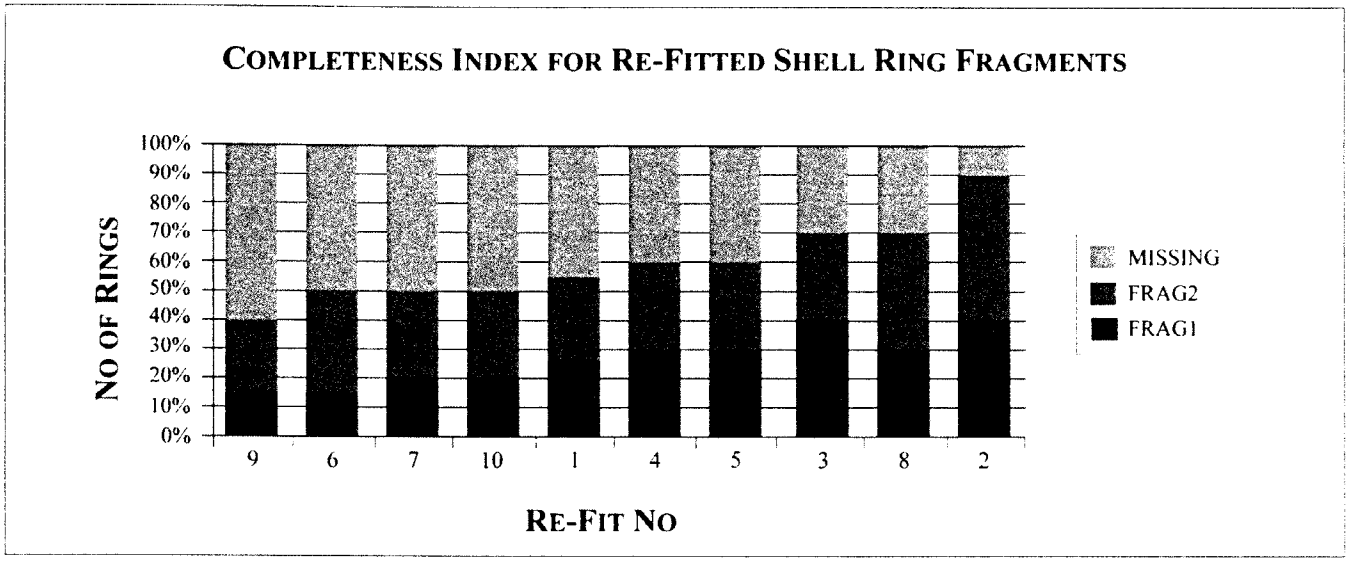


Figure 10. Completeness indices, re-fitted shell ring fragments

by House X and two Areas. Interestingly, there are no re-fits between different houses –an unexpected result that merits further discussion. Of the three re-fits with incomplete contextual data (Re-fits 3, 4 and 6), there is a high probability that the two parts of Re-fit 6 derived from different contexts, since one part was excavated by Stais/Tsountas and the other from House N by Hourmouziadis. In terms of the Domestic Activity Areas defined by Hourmouziadis (1979) and used by Halstead (1993), the three cross-contextual re-fits linked DAAs A and B (Re-fit 5), C and the Central Yard (Re-fit 7) and C and D (Re-fit 8).

There can be no doubt that the shell ring re-fits provide an element of dynamism and mobility in the account of the settlement's artifact distributions that has hitherto been missing. The basic pattern of the re-fitted fragments and the orphan fragments is more in tune with the notion of enchained relations linking cross-cutting household areas (Souvatzi 2007a; cf. Skourtopoulou 2006, n.d.) which supplements the domestic self-sufficiency often emphasized in the Hourmouziadis model. The existence of two re-fits between houses and open contexts (Re-fits 5 and 6) supports the emphasis on relations between different household areas. Inter-household connections as part of the creation and maintenance of social relations between persons or groups are indicated from many other lines of evidence. For example, the wide range of animals kept in each spatial segment points to intra-communal exchanges of livestock (Halstead 1992: 53, 55); the presence of craft-specialization in pottery, chipped stone tools and shell objects would have required interdependence and reliance on a wider social and economic system (Souvatzi 2007b, 2008); and architecture can also be viewed within a framework of shared relations, decisions and standards, given the space limits on the one hand and the precise layout of the overall settlement plan, on the other. The reason for the absence of shell ring re-fits between houses may be related to Dalla Riva's (2003) point that not all intra-village relations require extensive materialization, since they could have been mediated by face-to-face contact. Moreover, the missing parts of even re-fitted ring fragments probably betoken relations of enchainment between Dimini and other, inland sites, whose kinship ties were reinforced through the materiality of re-fitted objects. Such relations are already attested by other classes of material –for example by the widespread occurrence, on a regional and interregional level, of painted pottery of Classical Dimini Ware (Brown-on-Buff, with dense geometrical patterns arranged in panels) (Hourmouziadis 1978b; Schneider *et al.* 1994; Washburn 1983), including the site of Makriyalos in Macedonia (Vlachos 2002: 121, 123-124).

Before examining the biographies of the re-fitted ring fragments, we first turn to a broader study of all of the shell ring biographies.

Shell ring biographies

The study of shell ring biographies necessarily uses the individual shell ring fragment as unit of analysis. It follows the approach of characterizing the total range of features, both pre-depositional and post-depositional, with contextual analysis of these data. There is a total of 14 natural features, five features indicating manufacture, six features indicating use and only one feature indicating post-depositional processes (**Table 3**).

Here we concentrate on the natural features revealed by careful, incremental grinding. The natural features can appear on a wide variety of parts of the ring fragment, from one to eight different places, with a preference for three or four places (**Fig. 12**). By far the commonest of the natural features are the basic lines, found on 80% of rings, followed by sculpting (35%) and pitting (34%) (**Fig. 13**). All other natural features except notches, garlands and the color red were revealed on less than 10% of rings.

The making of the shell rings revealed up to five different natural features on any given ring (**Fig. 14**). Basic lines had been revealed on most of the ring fragments with only one feature (14 out of 19), with complex lines, pitting and sculpting found occasionally. Each of the four ring fragments with five natu-

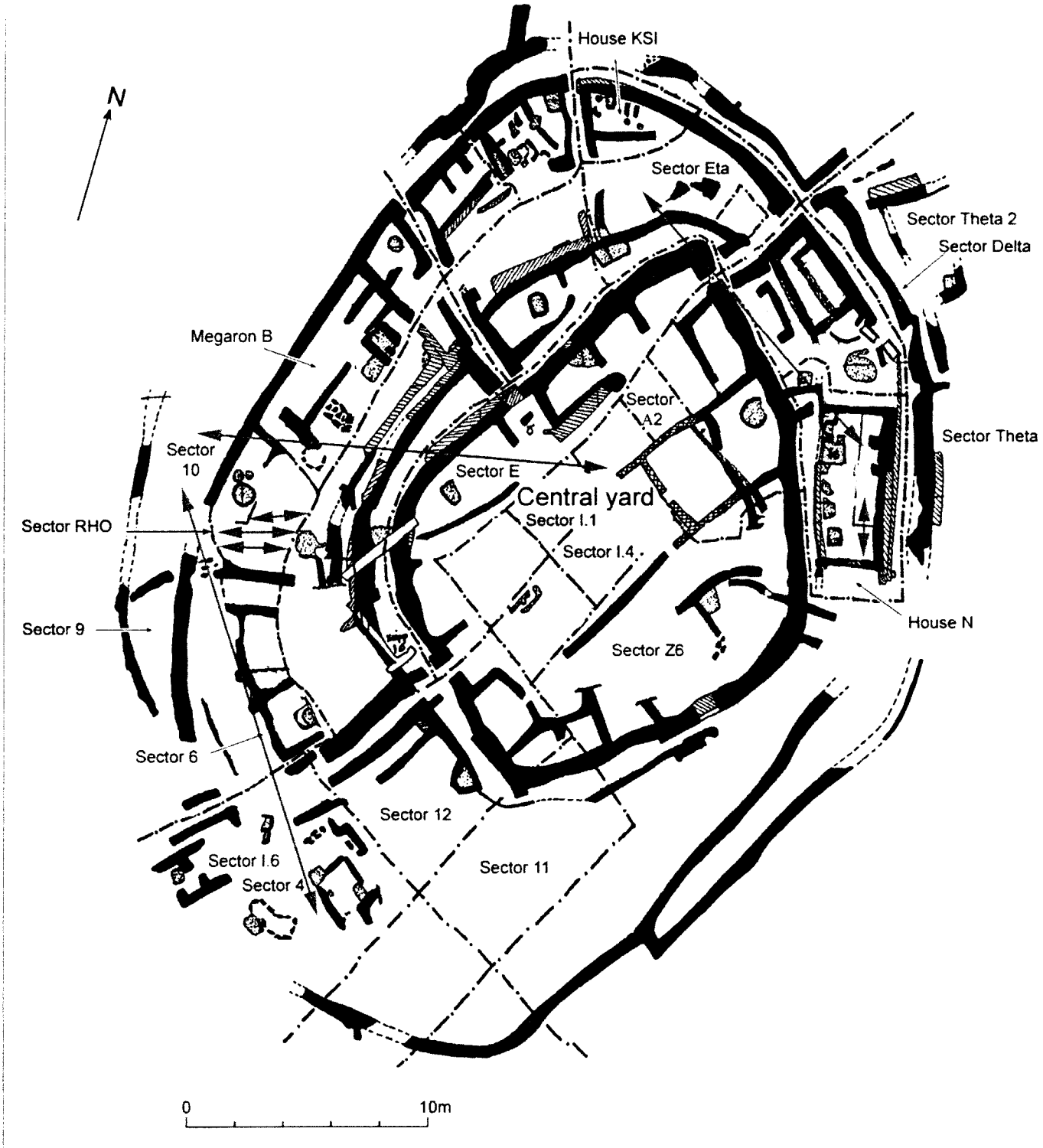


Figure 11. Spatial linkage of re-fitting shell ring fragments, Dimini

FEATURE	DIMINI	DURANKULAK	VARNA
Peaks in Inner Diameter	20 – 40%	50 – 70%	50 – 70%
No. of Natural Features	11	9 – 10	19
No of Feature Pathways	19	20	34
% of Complete rings	1%	46 – 86%	30%
Peak(s) in Completeness Index	20 – 40%	20 – 30% + 70 – 80%	10 – 30% + 60 – 70%
% rings + inter-context re-fitting	9%	0%	0%
% rings + intra-context re-fitting	11%	9 - 33%	24%
% of rings + burning	64%	2%	0,50%

Table 3. Differences between *Spondylus* ring assemblages at the Dimini settlement and the Durankulak and Varna cemeteries

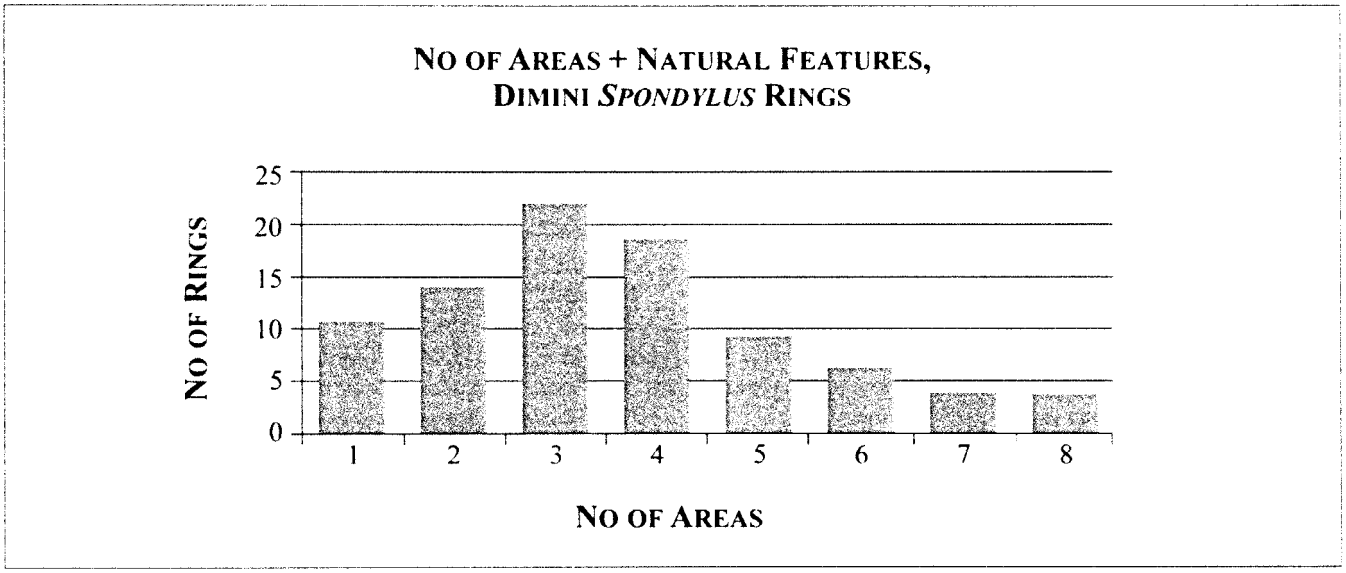


Figure 12. Number of areas on which natural features occur

ral features showed a different combination of features. This was typical of the process of revelation, which highlighted the emphasis upon difference between individual shell rings. However, a comparison of the popularity of various natural features at Dimini with those of the Varna and Durankulak cemeteries (Chapman & Gaydarska 2006) shows that each region had developed its own preferences within which individual choices were constantly being made (**Table 3**). We now turn to the later stages of the shell ring biographies .

Shell ring micro-stratigraphies

The next, and most important, phase in the investigation of biographical pathways was the establishment of micro-stratigraphies for each shell ring fragment –the sequence of events– natural and cultural– that changed the lives of the rings. There are five main events that could have occurred in the life of a shell ring: the selection of natural features; breaking the ring; burning; polishing; and "final" events (including wear, stress cracks and post-depositional deposits). Because of the high incidence of burning, we have the unusual possibility of sequencing these events more precisely, in a way that was not possible at Varna or Durankulak with shell rings, or even at Dolnoslav with fired clay figurines. We have found that, far from being a wholly negative force of destruction, burning of shell rings can have a pleasing aesthetic effect, highlighting natural features such as complex lines. The main difficulty has been in deciding whether and, if so, how the rings have been polished after burning. Experimental work has not yet succeeded in reproducing the effect of polishing after the burning of a marine shell.

The distribution of "phases" (the stratigraphic equivalent of an individual event) in the shell ring micro-stratigraphies ranges from three to seven, with a predominance of four and five stages, in comparison to a narrower range for the micro-stratigraphies of the re-fitted ring fragments (3-5, with a predominance of 4 stages) (**Fig. 15**). Let us consider two examples of these micro-stratigraphies. In the heavily burnt surface of M. Inv. No. 331, with its natural notch (**Fig. 5**), one break was unburnt (viz., the ring was broken after burning), while the

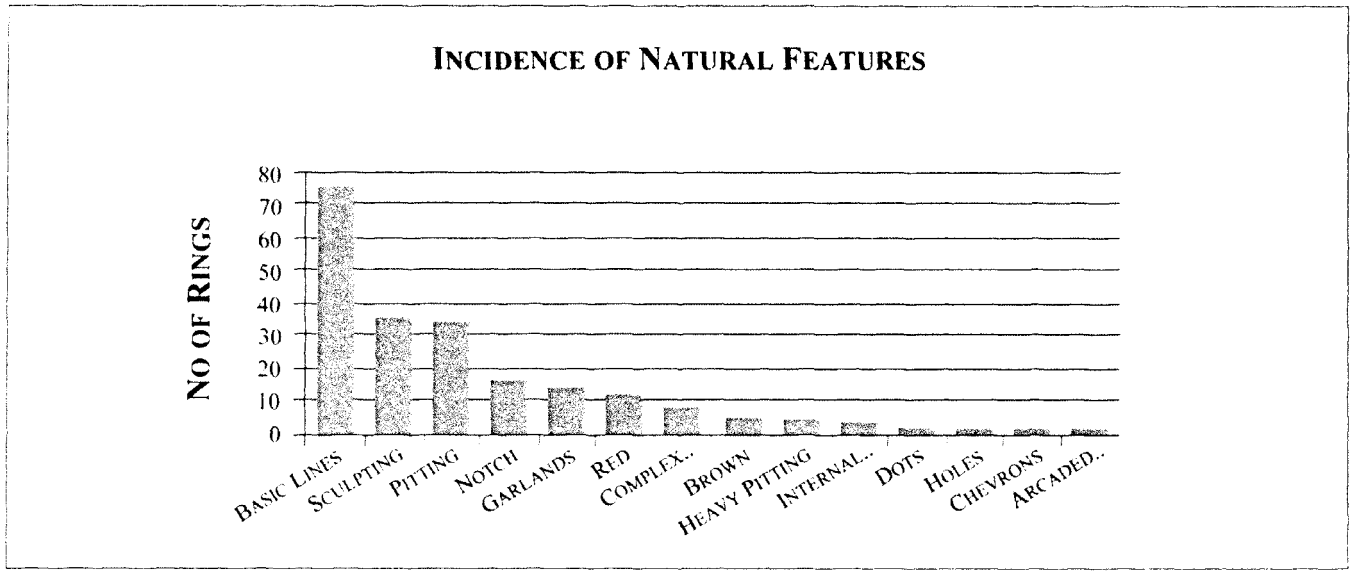


Figure 13. Incidence of natural features on shell rings

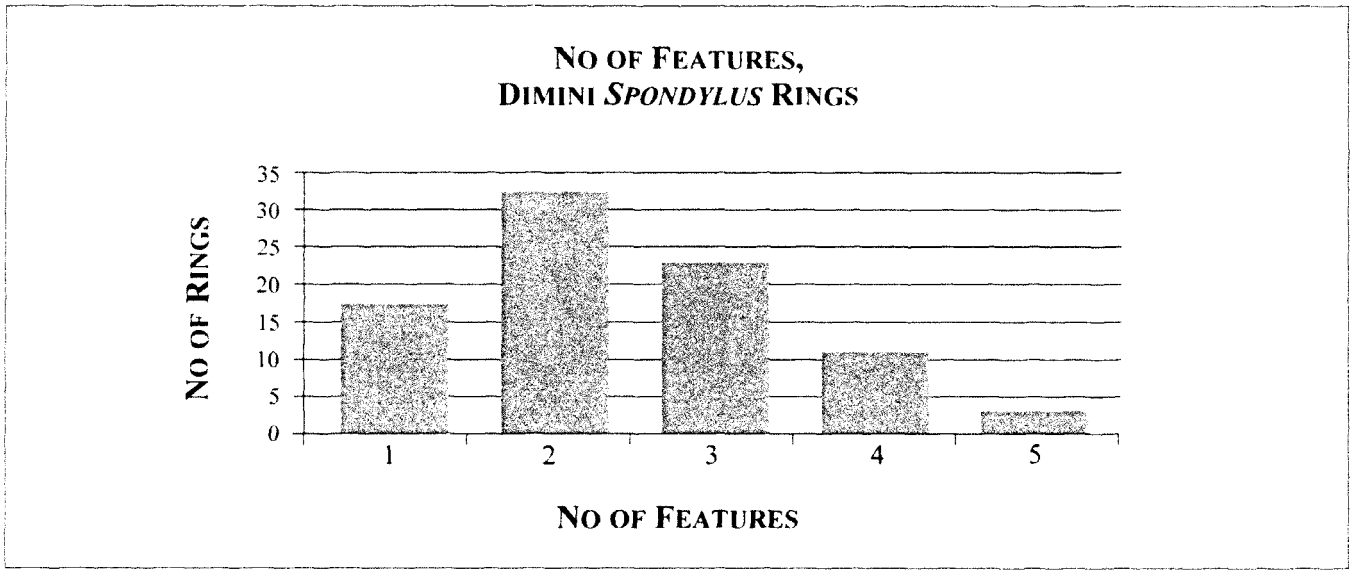


Figure 14. Number of natural features on shell rings

other break was burnt (viz., it was broken before burning). Another example is Museum Inv. No. 320.1 (**Fig. 6**), which displays different degrees of burning over natural lines and pitting. There is one unburnt break, while, at the other end, a flake of shell has been detached after burning. These examples show that the micro-stratigraphies resemble trench stratigraphies in their establishment of sequence without providing a time-scale between the events.

Eleven specific micro-stratigraphies have been identified, each occurring on more than one ring fragment. For the sake of greater clarity, these sequences have been clustered into four Groups:

- Group 1: burning after the break(s)
- Group 2: first break – burning – second break
- Group 3: break(s) after the burning
- Group 4: unburnt rings

The distribution of these micro-stratigraphical groups indicates that, of the two-thirds of burnt rings, 39% (or 35) rings (Groups 2 + 3) have been broken after burning –i.e. more than all of the unburnt rings. Within this total, 17 rings (18%) have been broken twice – once before burning and once after (**Fig. 5**), indicating a complex life history prior to final deposition. In the unburnt ring group (Group 4), there is one case of a ring which is broken once before, and once after, the laying down of brown deposit (e.g. **Fig. 4**), while, in another example, a deposit was formed after the break which followed the accumulation of use-wear. This result has two clear implications –that life "after the break" was quite normal for a reasonably high proportion of the Dimini shell rings and that burning was only sometimes the final social act prior to, if not part of, deposition.

One unsatisfactory aspect of the analysis is the grouping under one Phase ("final") of the results of three different processes

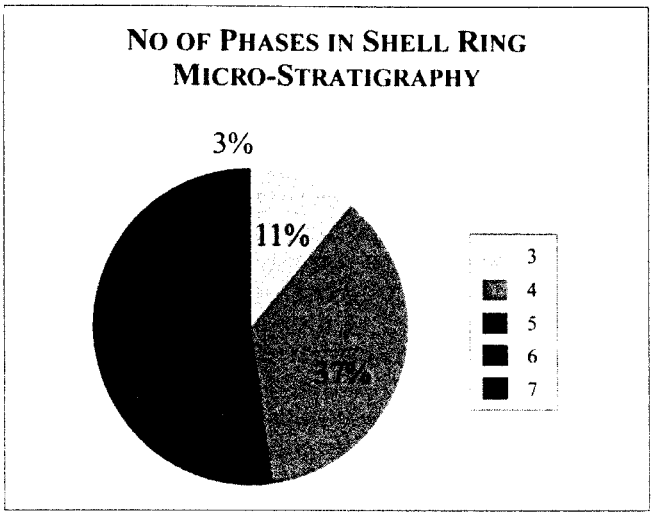


Figure 15. No. of phases in shell ring micro-stratigraphy

–wear from usage, stress marks from burning or another such practice, and deposits from post-depositional soil processes. Several interesting trends emerge with the unpackaging of these three different elements. The lowest proportion of rings with wear falls in Group 1, where the last Phase is therefore generally the burning Phase. Thus, for 21/23 rings in Group 1, burning is the last social act prior to deposition. This result stands in strong contrast to up to 1/3 of the rings from the other Groups, on whom use-wear traces appear "stratified" **over** the last break (**Fig. 15**). Thus, in some cases, there are two phases of life history for rings after they were burnt. This finding makes it hard to support the deliberate and competitive destruction of shell ring fragments by burning postulated by Halstead (1993).

The final analysis concerns the biographical pathways and micro-stratigraphies of the two parts of the ten pairs of re-fitted shell rings. Each re-fitted pair was compared in terms of negative matches (the mutual absence of a natural feature, a production feature, a usage feature or a post-depositional trace), positive matches (the co-presence of such a feature) and discrepancies (differences between the two fragments). First, there was no relationship between the percentage probability of the fragments re-fitting and the number of discrepancies in biographical pathway. Secondly, most of the discrepancies related to different natural features, some of which were specific to particular parts of a shell (n = 20 cases). However, there were six pairs with discrepancies in use-life (presence *vs.* absence of burning on Re-fit 2; presence *vs.* absence of wear on Re-fit 6; wear on one fragment, with flakes detached from the other on Re-fits 3, 4 and 7; and flakes detached from one fragment, with burning on the other on Re-fit 8). Each of these cases raises the possibility that the fragments went through different life experiences subsequent to the original breakage. The three discrepancies related to post-depositional deposits confirm the different depositional contexts in which two of the pairs (Re-fits 3 & 5) were found but does not explain the same depositional context for the two fragments comprising Re-fit 10.

A detailed comparison of the micro-stratigraphical groups of re-fitted pairs indicates that a majority of cases shared the same micro-stratigraphy (n = 6). However, in four cases, there were discrepancies (the presence *vs.* absence of burning on Re-fit 2; reversal of the order of breakage and burning on Re-fits 4 and 6; and the reversal of the order of breakage and deposit on Re-fit 8). As at Varna and Durankulak, these findings suggest the possibility of a different mid-life experience for these fragments after initial breakage.

INTER-SITE COMPARISONS

The biographical and re-fitting studies of the *Spondylus* shell rings from the Dimini settlement can be compared and contrasted with the other shell ring assemblages studied in detail (viz., the Durankulak and Varna cemeteries) and less precise information from North and Central Greek settlements such as Sitagroi and Ayia Sofia Magoula. The comparisons generate a rich pattern of variability in which the main differences are related to the contextual contrasts between settlements and mortuary arenas Recent AMS dates show chronological overlaps between Dimini, at 4790–4500 Cal BC (see above p. 142) and the Bulgaria Copper Age cemeteries of Durankulak and Varna at 4700–4400 Cal BC (Higham *et al.* 2007; Honch *et al.* 2006).

The main differences between the shell ring assemblages at Dimini, Durankulak and Varna has been summarized above (**Table 3**).

In summary, the Dimini shell rings turn out to be substantially smaller than the Durankulak and Varna rings, with regional differences in preferred natural features and natural feature pathways, despite the numerical overlap. The Dimini assemblage reveals far fewer complete rings and a very small proportion of large fragments, with the high proportion of burnt rings at Dimini further differentiating it from those of Durankulak and Varna. But perhaps the most striking difference is the relatively large number of physically matching and high-probability re-fits of pairs of ring fragments linking various settlement contexts at Dimini, in contrast with the absence of re-fitted rings between graves in either cemetery. The principal practice of re-fitting of mortuary fragments was within graves, while relatively few re-fits were made within houses or open areas at Dimini. What do these differences mean?

The key difference is that, while Varna and Durankulak were centers of spectacular mortuary consumption, Dimini and Sitagroi III were shell ring production sites as well as being places of consumption. There is an evident contrast in shell ring size between shell ring-making sites near the Aegean coast, where a full range of shell rings would have been made but only smaller rings were deposited, and inland Central Greek or Black Sea shell ring-importing groups, who exchanged valuables for the larger rings (or ring fragments?) so vital to their social reproduction in settlement or mortuary rituals. The mean interior diameter of 'production sites' is generally small: 35mm at Sitagroi (Shackleton 2003: 363), with larger diameters in Phase III (Nikolaidou 2003: 339-340); 35mm at

Dikili Tash (Karali-Yannakopoulou 1992: 163); 45-50mm at Dimitra (Karali-Yannakopoulou 1997: 209); and 50mm at Makriyalos (Pappa & Veropoulidou, this volume). However, the importing groups were concerned not only with ring size but also with the quality and diversity of natural features that had been revealed through grinding and polishing. While the Durankulak and Varna communities showed preferences for rings with certain natural features although, interestingly, rings with **no** additional features beyond their natural color and brilliance were also popular, rings with basic lines, pitting and sculpture, singly or in combination, were preferred for deposition at Dimini. At every site, there are parallels between the natural *Spondylus* features selected and motifs on decorated pottery. Bearing in mind the different raw materials in question, it is very tempting to examine in the future the parallels between the natural *Spondylus* features selected and features on decorated pottery (i.e. the red appearance of some *Spondylus* rings (Chapman & Gaydarska 2006: Pls. 38 & 42) and the use of red crusted decoration on pottery), bearing in mind that close parallels could also be traced between decorated pottery motifs and figurines as well as spindle whorls (Souvatzi & Skafida 2003: 433).

The importance of complete shell rings in the mortuary assemblages is itself very variable. We suggest that two competing practices were in tension –the custom of integrating the totality of relations embodied in the object deposited in the mortuary domain and the practice of emphasising the partible nature of the relationship between the newly-dead and the living by keeping ring fragments in separate contexts. The meaning of these patterns for Dimini is threefold: the low significance of integrated biographical relations as shown by the single complete ring; the greater importance of materialized intra-site relations, as shown by the re-fitting shell ring fragments; and the greater significance of enchained relations between residents and others living away from the site, as embodied in the high proportion of orphan shell fragments. This last point may be noted at Sitagroi (2% complete shell rings: Nikolaidou 2003: 337) and Ayia Sofia magoula (0/12 rings complete: Tsuneki 1987). This interpretation is further supported by the low completeness index of the vast majority of the Dimini shell rings. The recurrence of ring fragments measuring approximately 1/3rd of the ring circumference suggests that rings were perhaps being regularly divided into three parts at or near Dimini, as a means of systematizing enchained relations between three people or between three categories of person.

The identification of inter-context re-fits in the Dimini shell ring assemblage demonstrated that it was the mortuary context that was responsible for the absence of ring re-fits at Varna and Durankulak rather than the shell material itself. Although it seems that day-to-day interactions would also have reduced the need for materialization of inter-household relations at Dimini, the existence of inter-context re-fits suggests either that children, or other mechanisms, moved ring fragments between spaces or that a more structured practice linked spaces and their habitual occupants. The latter is more likely in view of the social, ritual and possible cosmological significance of the shell rings. Such fragment dispersion could have occurred in the course of the often lengthy use-lives of the shell rings, which show several stages of change after the selection of the final form of the natural features. Thus, after the breakage of one shell ring, the fragments were taken into different households and each used in different ceremonies, leading to different biographies that took the ring fragments into different final places of deposition. At Dimini, such ceremonies were much more frequently linked to burning than in the Black Sea cemeteries – burning that sometimes resulted in the enhancement of the surface patterns in black as a symbolic reversal of the *Spondylus*' normal color. There is also the possibility that the shell rings were burnt in the course of cremation practices, as attested in the Thessalian Late Neolithic at Soufli magoula and Platia Zarkou magoula (Gallis 1996). The possibility that the Dimini shell rings were presencing a mortuary ritual involving the deaths of important members of the community brings the Dimini rings contextually closer to those from the Black Sea zone.

A contrasting intra-site pattern to the burnt shell rings is found in the distribution at Dimini of anthropomorphic figurines, only 13% of which are burnt. This suggests that a rather low percentage of figurines was used in ceremonies that involved secondary burning. While most of the figurines with secondary burning were deposited in burnt contexts, the high proportion of figurines without secondary burning found in burnt contexts suggests that these images had been placed after the fire had died down, as part of rituals of commemoration and closure (perhaps as with unburnt *Spondylus* rings in House N). Although there is only one figurine with secondary burning in an unburnt context, it is still a sign that figurines were used in rituals involving fire well before their eventual deposition (Skafida, in prep.).

What do these findings mean for the creation of personhood at Dimini? In the first place, the unequivocal evidence for deliberate ring fragmentation at Dimini –whether the re-fitting data with different uses of the re-matched parts or the micro-stratigraphic evidence for use of fragments "after the break"– means that there are enchained processes linking those who broke and divided the rings, exchanged or kept the parts. The logic of fragment enchainment is that the creation of personal identity was linked to relations with other persons mediated by object fragments, each of which itself embodied a chain of relationships stretching back to the beginning of its object biography.

Secondly, we can glimpse a lifelong process of individualization of persons and shell rings which is particularly appropriate to the Dimini shell rings in view of their long and complex biographies. The partible relations of those owning/using shell rings stretch back to the shell-divers who retrieved the shells and brought them back from such dangerous zones. They continued through the skill of the shell ring makers whose selection of techniques and mastery of revelation brought forth the natural features that were so attractive and so different in each shell ring. For inland settlers and those living on the Black Sea coast, these relations were further enhanced by the long-distance specialists whose status, in turn, depended

upon the completion of trips from home and hearth to remote and dangerous areas and to communities speaking a different language. Each person had their own biographical fame to offer an enchained relationship materialized through the *Spondylus* shell ring. Just as every contribution was different, so the physical form and characteristics of each ring was different –depending on its color, size, natural features and those features accreted during the life of the ring, forming a basis for differentiation of the histories that were recounted of each shell ring. This suggests that Nancy Munn's (1986) verdict on the kula trade –that the fame of each person was inextricably linked to the fame of each shell– can be extended to fragmented objects –the fame of fragments of shell rings were linked to the fame of the related fractal persons. Phrased in another way, there were links between the physical features of the ring (e.g. its breaks) and the partible relations represented by its biography (i.e. all those inter-related persons connected with its making, using and breaking).

Thirdly, the existence of more and less important inter-personal relations within the village or the household would have determined the strength of specific enchained relations. Clearly, the inhabitants of House N played a key role in enchained relations based upon *Spondylus* ring distribution, since this was where many, if by no means all, of the shell rings were produced. Each of the "producer" households had already developed extensive enchained relations to the shells' source areas of rocky beaches, as well as to the divers and collectors if members of the households did not possess diving skills. The absence of shell ring re-fits between households may be explained by the similarity of enchained relations that each household established at an early stage of the shell ring biography. These inter-personal links, mediated by the shells, would have been consolidated into deeply personal embodiments of the production skills of the household shell ring makers, whose identities were forever linked to the newly created shell rings. The burning of the complete rings in some household or collective ritual led to the accretion of further layers of identity on the ring surface, enchaining those participating in the ritual. The deliberate breaking of the shell rings led to the dispersion of the maker's identity across the social space of the village, if not further. Further burning of already broken rings, not to mention post-fracture wear, established visual relations denoting further social action. Villagers in the 'production sites' would have been enchained to those fragments used for exchange with inland Thessaly and the southern Balkans, as well as to those long-distance specialists from their own village who used the shell ring fragments to procure through barter other exotic objects for their home village (Helms 1993). This was why the villagers would have maintained a special interest in the fate of those specialists as much as the fate of the shell ring fragments themselves. At each stage of the shell ring biography, the visual signals of not only technical processes but also social practices linking a ring to different persons was sedimented on the surface of the shell ring. The multiplicity of these links is confirmation that shell ring biographies were an important constituent of fractal personhood –the creation of dividual persons through links with other persons.

CONCLUSIONS

Our analysis of the biographical data suggests that the *Spondylus* shell ring assemblage from Dimini is highly fragmented, variably burnt, not very worn and with many ring fragments having a long and complex life-history. The size of the shell rings, as measured by the inner diameter, indicates that a very small percentage of the rings, when complete, could ever have been worn by even the smallest child. The Dimini ring size is far smaller than that of the mortuary assemblages at Durankulak and Varna I, North East Bulgaria. The Completeness Index of the Dimini assemblage lacks the moderate frequencies of 50-80%-complete examples that characterize the two Bulgarian assemblages; most of the Dimini shells are less than 40% complete and only one example is 100% complete, in comparison with 30% of the Varna cemetery rings being deposited whole.

The re-fitting exercise proved stimulating and not a little problematic. Of the 96 fragments studied, only one physical match of two fragments was found. However, the probabilities of two fragments belonging to the same ring was estimated based on criteria such as (1) color; (2) inner diameter; (3) special characteristics; (4) polish and (5) width. On this basis, a further nine pairs of ring fragments were judged to have probabilities of between 50% and 90% of belonging to the same ring. Accepting these probabilities, we have a high percentage of re-fits, amounting to 21% in comparison to the re-fitting percentages for any of the Bulgarian figurine assemblages that we have studied. This suggests an answer to one of our primary research questions: was it the context of the shell rings that was important for re-fitting or its material? Clearly, the domestic context rather than the mortuary context is the vital issue at stake here, not the material from which the objects were made.

Of the ten potential re-fits, three were made between ring fragments deriving from different contexts (one from a house to an Area, the others between two Areas), four were from the same context and three had one or both contexts unrecorded. The distances involved between contexts ranged from 100m to 370m, across two or three separate Areas. Given the significance of the material, there is a low probability that such fragment dispersal could have happened by chance and the contexts involved do not include material in secondary deposition. Our preliminary conclusion is therefore that *Spondylus* shell rings were deliberately fragmented some time during their lifetime and the separate fragments were deposited in different places by persons whose social relations were underpinned by enchainment mediated by shell ring fragments.

Initial examination of the details of the life histories of the shell rings indicates very variable biographies. One example is the extent of burning, whose traces on the rings ranged from none to strong. There appears to be no burnt shell ring fragments in any open area but Area R. In this context, and in House N –both with larger frequencies of shell rings than elsewhere– each class of burning is found, suggesting that this is

not a pattern produced by deliberate house or area burning but rather a deliberate selection of a wide range of colors and surface features for deposition. In several cases, signs of activity since the break and since burning show long life-histories of certain rings. The variability of micro-stratigraphies involving burning combines with the contextual discrepancies between the deposition of unburnt rings in burnt contexts and vice versa (and also figurines!) to indicate that the use of fire was a carefully controlled method of transformation that was not indiscriminately applied to all objects but to certain shell ring fragments and figurines at specific stages of their biography.

How do our results contribute to the debate over the Dimini *Spondylus* shell rings? Our study has not changed Tsuneki's conclusion that all stages of the *chaîne opératoire* of ring making were present in several locales at Dimini, which was therefore a production site. What we can say, however, is that his insight that the rings were broken as a result of production mishaps is essentially impossible to sustain. There are numerous examples of a complex life history in ring fragments that do not support the Tsuneki hypothesis. Equally, our findings do not support Paul Halstead's hypothesis of the deliberate destruction of shell rings by burning as part of inter-household competition, since many ring fragments show signs of life after burning. The possible extension to the Halstead hypothesis of the further use of burnt and broken shell rings by successful households after the potlatch ceremony does not fit well with enchainment theory, insofar as the enchained relations mediated by the ring fragments embodied relations of solidarity rather than competition. The concentration of shell rings at Dimini that suggested an élite settlement to Kyparissi-Apostolika is still valid. Enchained exchange of shell rings inland or North to the Balkans was one way of sustaining élite relations, either through long-distance movement of special individuals or through a series of local enchained, inter-community exchanges of the kind well documented for both exotic obsidian and local chocolate flint in Neolithic Thessaly (Karimali, in press). But, at a more fundamental social level, the fragmentation of shell rings at Dimini shows that partible relations using parts of objects may have been basic social practices for many people in Late Neolithic Greek society. Each person was created through a series of relationships with every other person whom s/he encountered. This permeable kind of personhood is well known from recent Melanesian societies who, by contrast, use complete objects in sequential exchange to validate their enchained relations. What is different about prehistoric communities in the Balkans and, now, through this study, in Greece is the way that parts of objects were just as frequently used **at the same time** as complete objects to sustain and enhance their enchained relationships. There can be no better example of this principle of fractal personhood than the *Spondylus* shell ring assemblage from Late Neolithic Dimini.

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