

Sunk Costs at Late Bronze Age Uluburun

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This study gauges the economic loss represented by the 14th-century B.C.E. shipwreck at Uluburun, Turkey. Textual evidence for commodity values are used to calculate a minimum cost for the main cargoes and ship. Values are converted to silver shekels of Ugarit's standard. The approximate sum of 12,000 shekels is contextualized by contemporaneous indicators found in Akkadian and Ugaritic business documents, treaties, decrees, Hittite laws, and Ramesside prices. It is hoped that this provisional estimate will inform and stimulate continued investigation into the sort of institution capable of outfitting such a rich venture, and provide a means to gauge the loss suffered by communities most likely affected.

OVERVIEW

The Uluburun shipwreck, excavated by the Institute of Nautical Archaeology in consecutive seasons from 1984 to 1994 (Pulak 1998; 2008), is now a routine component in discussions of exchange in the Late Bronze Age Mediterranean world (Manning and Hulin 2005; Bloedow 2005; Bachhuber 2006; Cline 2007; Van De Mieroop 2007; Knapp 2008; Monroe 2009).¹ After more than a decade of post-excavation studies treating its cargoes, Uluburun ranks among a handful of sites that define how archaeologists view the Late Bronze Age and discuss it, both among peers and with the public. It has become iconic as a tangible, material expression

of a complex economic and cultural phenomenon.² Beneath the surface of Uluburun, however, is a thorny epistemological problem stemming from the fact that the socioeconomic relationships to which it attests are apt to be more intercultural than culture-specific. Bass observed from early in the excavations (Bass 1987), as have others since (e.g., McGrail 2001: 122), how the Uluburun discovery enriches our knowledge of an opulent trading network without unambiguously proving who carried the goods or what their motives were. This paper addresses one facet of the ongoing interpretation of Uluburun and what it represents about Bronze Age trade: estimating how much wealth was lost in one particular maritime venture.

Attempts to classify the Uluburun shipment have generally swung between two metaphors. Many see it as a royal shipment, yet the presence of multiple balance-pan weight sets and the ship's apparently mixed crew (Pulak 2000a; 2005) suggest entrepreneurial motives and complexities not directly predicted by a royal gift exchange model and its ideological and "irrational" aspects (Liverani 1979).

¹ "Sunk cost(s)" is a term used in economics and business that refers to irrecoverable expenditures, losses, or investments, including expenses incurred in the development of a new product. Thus, they are generally "written off," and they have no anticipated salvage value. The term is taken here both for its common meanings and for purposes of musing on the loss of crucial assets physically sunk and the degree to which history can recover the magnitude of sunken assets lost. The opportunity to present my findings at the 2008 ASOR annual meeting in Boston was helpful in reaching the formulations described here. I am especially grateful to Ezra Marcus, both for editorial comments and for initial discussions that were instrumental in approaching the Uluburun shipment in terms of quotidian indicators of value.

² Uluburun's place in the discourse on Bronze Age trade was spectacularly illustrated by the 2008–2009 exhibition, *Beyond Babylon: Art, Trade, and Diplomacy in the Second Millennium B.C.*, curated by Joan Aruz at the New York Metropolitan Museum of Art, where the shipwreck occupied center stage (Pulak 2008).

As will become apparent below, the results of this study may be used to inform either of these two interpretations; it is not intended to definitively argue for one model or another.

As an archaeological data set, the Uluburun shipwreck presents myriad opportunities for fruitful interdisciplinary analysis. Assessing the significance of Uluburun has so far required some of the more technically advanced tools available to modern archaeology, specifically those concerning cargo provenience and chronology (Serpico and White 2000; Manning et al. 2001; Hauptmann, Maddin, and Prange 2002; Stern et al. 2003). Recently, shape analysis of a mouse molar (still in the mandible) found among the copper ingots has been used to argue for Minet el-Beida having been one of the ship's last ports of call (Cucchi 2008). The spatial context of the shipwreck also poses historiographical challenges, due to the remarkable variety of textual corpora with which the doomed shipment can be demonstrably associated. The impact of a single long-distance exchange of goods in the closing years of the 14th century B.C.E., a time when several competing and expanding empires became economically interdependent, perhaps for the first time in world history (Sherratt and Sherratt 1991; Sherratt and Sherratt 1993; Zaccagnini 2000), is a prime topic for the economic historian, provided sources can be found to measure the value of goods, services, and labor that would contribute to the outfitting of such a venture. Here I aim to take an initial step along this path. Future scholars will have the Uluburun final report, more cargo studies, and fuller textual data to bring to bear, but there is presently enough documentation to begin quantifying the archaeological material in terms of contemporaneous notions of value.

METHOD

Two main tasks are undertaken here: first, to place a value, in shekels of silver, on the bulk of cargoes from Uluburun for which price data are available; second, having determined a minimum value for the wreck, to contextualize that value by comparing it to certain benchmarks—yearly salary, the price of a sheep or day's supply of grain, etc. Through this twofold process, the loss of the Uluburun ship can be viewed in something approaching its own terms. This determination should improve our understanding of the socioeconomic energies that shaped Late Bronze Age Mediterranean trading practices. Was the

capital involved beyond the capabilities of small, family-organized firms; that is, was it firmly contained within the sphere of palatial interests and partnerships? Or can one feasibly hypothesize that Uluburun was a private entrepreneurial undertaking? Was the loss of the shipment at Uluburun catastrophic or merely a "sunk cost" of doing inherently risky business on the high seas? These are the sorts of questions a determination of values may profitably address. Other theoretical problems surround the specific cultural meaning of "price," as opposed to simply "weight" or "equivalence," and are topics more suited to the arena of the substantivist-formalist debate. Mostly this is left aside, though one may refer to Powell (1996), Snell (1997: 145–58), and Monroe (2005) for relevant summaries. One may further note that even in the socially embedded confines of the royal correspondence from Amarna, gifts were sometimes tallied with their value in weights of precious metal because silver and gold were of primary interest in the exchanges (Zaccagnini 2000).

In this paper, all price data are converted into Ugarit shekels and into units of silver per kg or liter (summarized in table 2). This is justified mainly by Ugarit's centrality, not only in a geographic sense as an entrepôt connecting all the major empires of the Late Bronze Age world (Yon 2000; Mederos and Lamberg-Karlovsky 2004: 199), but because of the relative abundance of information in its textual corpus. The shekel of Ugarit was known to the Hittite and Egyptian courts and weighed 9.4 grams (henceforth, g) (Mederos and Lamberg-Karlovsky 2004: 202; cf. Pulak 2000a for weight of ca. 9.3 g). Fifty Ugarit shekels made up a mina, weighing approximately 470 g, and 60 such minas made up the Ugarit talent of ca. 28.2 kilograms (henceforth, kg). Most of the intact weights excavated from the Uluburun shipwreck conformed to this standard, comprising at least seven sets, though a minority of weights from the Mesopotamian standard and another Levantine standard were present (Pulak 2000a: 262–64; Alberti and Parise 2005: pl. 86b). In reckoning prices in silver, I also follow Snell (1995), who references the widespread use of silver as both a medium of exchange and means of accounting in the eastern Mediterranean and Near East. This is not to ignore local practices, as in the case of Egypt, where many equivalences were recorded in units of copper (Leprohon 2004) rather than silver or gold. Likewise at 15th-century Alalakh, prices of mostly inexpensive commodities were recorded in copper (Wiseman 1953: 14). On the other hand, when scribes at Ugarit, Egypt,

and elsewhere were evaluating large figures such as the value of maritime ventures or caravans, silver was usually used, or sometimes even gold (Courtois 1990: 126).

While certain currencies, such as copper, gold, barley, and tin, are attested in various localities within the current scope, it is fortunate that ancient scribes often compiled or compared values in terms of weight in silver bullion; fortunate too that the various weight standards—i.e., the local variations in weight of a shekel—were readily converted from one local standard to another. Specifically, one deals mainly with three well-known Levantine standards whose variance in the size of the shekel and the number of shekels making up a mina range between 470 and 480 g. The Karkemish standard had 60 shekels of 7.83 g; the Ugarit standard had 50 shekels of 9.4 g; and the Hittites used the largest shekels, 11.4 g, 40 of which made up their mina (Mederos and Lamberg-Karlovsky 2004: 203; Alberti and Parise 2005: 381–82, pl. 83). Because of the simple 4:5:6 ratio, these different Levantine standards were readily interchangeable, and given that the absolute mass of all these standards is known (with acceptable variance), all figures can be reliably converted to Ugarit shekels for purposes of comparison. Additionally, the New Kingdom *dbn* of 91 g is the standard frequently employed in the Egyptian sources alongside the *qdt*, which corresponded to the Ugarit standard. The sexagesimal Mesopotamian standard having shekels of 8.4 g and heavier talents of 30.2 kg was also known in the Levant; one or two sets of shekel-based weights from this standard were found at Uluburun (Pulak 2000a; Alberti and Parise 2005: pl. 86b).

I am naturally indebted to equivalence studies in the fields of Assyriology and Egyptology, upon which all here is based, including important works by Cross (1937), Janssen (1975), and Heltzer (1978). Especially for Ugarit, one must also note important corrections, comments, and additions made by Stieglitz (1979), Healey (1983), Rummel (1982) and Vargyas (1986). Price data from recently published Hittite laws (Hoffner 1997: 7–11, table 2) are also especially important here, as they provide comparanda to values attested at Ugarit from the same period, during which time Ugarit was a Hittite protectorate (Singer 1999: 627–83; Bryce 2005: 163–66).

VALUE OF CARGOES

Most of the items found among the spectacular cargo at Uluburun, listed readily in Pulak (1998) and

beautifully illustrated in Pulak (2008), cannot be reliably priced, and so I must first admit that whatever value is determined must be seen as a low estimate. Nevertheless, some of the predominant cargoes can be reliably gauged from textual price data. These include copper and tin (the two heaviest cargoes), and terebinth resin (with minor reservations, outlined below). Beside cargo, some ship timbers, rope, and even an entire ship (with substantial reservations, outlined below) can be priced. Among the obviously valuable cargoes that cannot be reliably priced at this time are 175 discoid glass ingots, 80 pieces of Cypriot fineware, gold and silver scrap jewelry and/or bullion (at least half a kilogram), numerous bronze weapons (including Mycenaean and Canaanite swords, daggers, and spearheads), several poorly preserved bronze and copper vessels, Egyptian ebony logs, and ivory blanks and finished ivories. This list could be continued, belaboring the point that I am estimating a minimum value. Prices of these few Uluburun cargoes are listed in table 1. Table 2 contains textually attested values for various goods discussed in this article, including those in table 1. Every value in table 1 requires discussion and clarification, but immediately one can calculate a rough minimum of over 11,000 Ugarit shekels of silver.

The Copper

The copper cargo is the heaviest that was aboard, and one of the bulkiest, stacked 8 to 12 ingots high in four rows in the hold (Pulak 2000b). Based on lead isotope analyses that demonstrate consistency with Cypriot ores, it is widely believed that these ingots were loaded in Cyprus, along with Cypriot pottery that was packed for shipping inside Cypriot pithoi (Pulak 2000b; Stos-Gale 2000).³ Despite copper's obvious importance to all the economies of the eastern Mediterranean, there are only a few documented equivalences. Hittite Law §181 states that 4 minas of copper were equivalent to 1 shekel of silver (Hoffner 1997). According to Hittite measures, this implies that a talent, or 60 minas, of copper in the Hittite sphere was worth 15 shekels. It is certainly no coincidence

³ The provenance of the production of Mediterranean copper ingots is still provisional, based on compositional consistency between ores and smelted copper. This fact is fully addressed by Knapp (2000: 47), who cautions that “we remain at the outer perimeter of understanding who mined the copper and how they lived; who produced the ingots and from which ores; and who orchestrated their distribution throughout an economic system spread across the Bronze Age Mediterranean world.”

TABLE 1. Cargoes from Uluburun Priced in Ugarit Shekels of Silver

<i>Item</i>	<i>Amount</i>	<i>Unit mass or volume</i>	<i>Total mass or volume</i>	<i>Unit price</i>	<i>Total price</i>
Copper, ox-hide	354 ingots = 325 talents	1 Ugarit talent = 28.2 kg	9165 kg	15 skl/talent	4,875
Copper, bun	130 ingots	6.2 kg	806 kg	0.5 skl/kg	403
Copper, oval	5 ingots	8.8 kg	44 kg	0.5 skl/kg	22
Copper, pillow	5 ingots	10.75 kg	53.75 kg	0.5 skl/kg	27
Tin	1 ton	n/a	1,000 kg	0.5 skl/kg	500
Gold scrap and chalice	37 pcs.	n/a	0.5 kg (= 53 skl)	425.5 skl/kg	212
Terebinth resin	1 ton or 1,000 liters (in 149 jars)	avg. 6.7 liters/jar	998.3 l	0.025 skl/liter or 5 skl/liter	ca. 25 or 5,000
Ship's timber	Pulak 1999	15 m keel	n/a	58 shekels	392–ca. 540
		15 m mast		29 shekels	
		42 planks		101 shekels	
		2 yards		194 shekels	

TABLE 2. Prices of Pertinent Goods, Converted to Ugarit Shekels

<i>Item</i>	<i>Term</i>	<i>Source</i>	<i>Quantity, @ stated price</i>	<i>Ug. skl</i>
Copper Hatti Ugarit	urudu	Hoffner, Laws §181	4 mina (2.052 kg), @ 1 shekel	0.609 /kg
	𐎶𐎵	<i>KTU</i> 4.337:6–8	1 talent (28.2 kg), @ 15 shekels	0.532 /kg
Tin	brr	<i>KTU</i> 4.337:1–5	1 talent (28.2 kg), @ 1 shekel	0.532 /kg
Gold	ḥrṣ	<i>KTU</i> 4.341:18	10 shekels (94 g), @ 40 shekels	425.53 /kg
	ḥrṣ	<i>KTU</i> 4.337:20	2 shekels (18.8 g), @ 8 shekels	425.53 /kg
	ḥrṣ	<i>KTU</i> 4.341:5–6, 20	2 instances of 1:3 ratio pricing	372.34 /kg
Terebinth resin	snṯr	Pap. Turin 1907/8	2.5 dbn (227.5), @ 10 hin (4.8 l)	0.025/liter
		(Janssen 1975: 445–46)	[metal unstated—copper or silver?]	[or] 5.04/liter
'š timber, mast	ḥt-ṭw	Giornale 13, 2, 3–6	38 cubits (ca. 19 m), @ 3.8 dbn Ag	36.8
		(Janssen 1975: 377–78)	30 cubits (ca. 15 m), @ 3 dbn Ag	29
'š timber, keel	pḥypt	Giornale 13, 2, 10–12	30 cubits (ca. 15 m), @ 6 dbn Ag	58.1
		(Janssen 1975: 379–80)	40 cubits (ca. 20 m), @ 8 dbn Ag	77.4
'š timber, plank	iswt	O. Cairo 25 543, 7	5 planks (length n/a), @ 1.25 dbn Ag	2.42/plank
		(Janssen 1975: 375–76)	(0.25 dbn per plank)	
'š timber, yard?	irkt	Giornale 13, 1, 12–17	50 cubits, @ 10? dbn Ag	96.8/pair
		(Janssen 1975: 378–79)	45 cubits, @ 5 dbn Ag	
Timber, Ugarit	'šm	<i>KTU</i> 2.26	10 logs, 60 shekels	6/log
		(Pardee 2002: 3.45Q)		
Timber, Ugarit	šmn,	<i>KTU</i> 4.158	12 pcs, size n/a, @ 1 shekel	1 /doz
	tišr, dprn	(Stieglitz 1979: 17)	log, @ 1 shekel	1 /log
Bronze basin	agannu	<i>Ug.</i> 5 38:25–37	1 talent weight, @ 100 shekels	3.55 /kg
		(Stieglitz 1979: 18)		
Royal silver bowl	mšq	<i>KTU</i> 4.265	260 shekels silver, @ 80 gold	260–320
	mlkt	(Stieglitz 1979: 18–19)	(= 320 silver, or 23% increase)	

that the price at Ugarit was also 15 shekels per talent, as noted in the alphabetic cuneiform tablet *KTU* 4.337 (Stieglitz 1979: 18; Courtois 1990: 124). Since both the Hittite shekel and talent were heavier than their counterparts in Ugarit, one must ask whether the apparently identical price in silver was equiva-

lent to equal masses of copper. Roughly they are. If one takes Hoffner's figure of 30.78 kg for the Hittite talent, then 4 minas (or 4/60 of a talent) would equal roughly 2 kg (2.052 to be exact). Hittite copper was thus priced at 0.5 shekels per kg. Calculating likewise for the Ugarit price, 1 kg of copper cost 0.532

shekels of silver. It appears at first that copper was slightly more expensive at Ugarit, but the opposite is true, since a shekel (9.4 g) at Ugarit weighed less than a Hittite shekel (11.4 g). A comparison by mass then shows that copper was slightly more expensive in Hatti (6.4 g silver per kg) than in Ugarit (5 g silver per kg), which is hardly surprising if transport costs from Cyprus are imagined. Other prices of copper and bronze items compiled by Heltzer (1978; cf. Vargyas 1986: 110; Heltzer 1999: 447) suggest prices at Ugarit narrowly ranging between 0.45 and 0.53 g of silver per kg of copper. Thus I conclude that the prices from Hatti and Ugarit are a reliable indicator of value, which I take to be a half shekel per kg, as it appears in table 1.

The Uluburun copper comes in four distinct forms which are accounted for in table 1. In each case, an average mass is used, since precise measurements would be meaningless in the face of differential preservation and loss of metallic content over time. Again, I am looking at minimums. According to Pulak (2000b), the 354 ox-hide ingots (317 whole plus 37 quartered and halved ingots) amount to roughly 325 talents, assuming that each complete (as opposed to fractional) ox-hide ingot was roughly equivalent to the Syrian talent of 28–29 kg. The other forms—pillow, bun, and oval—cannot be reliably connected to an ancient standard, but the 130 plano-convex or “bun” ingots appear to be roughly a fifth of a talent each. The copper from all forms tallies up to a primary cargo worth at least 5,327 shekels silver at Ugarit. How much that amount was worth in economic terms will be discussed in the second part of this paper.

The Tin

The tin ingots from Uluburun are remarkable for being the only known preserved tin ingots from the Bronze Age Mediterranean world. Though not preserved as well as the copper, enough was found for Pulak to identify several forms and make a reasonable estimate as to the size of this cargo. Ox-hides, mostly halved and quartered, some buns, and a unique anchor-shaped ingot were found but were too poorly preserved for accurate weighing. Pulak (2000b: 138–40) has estimated the original weight of the tin as 1 ton. This would provide an amount appropriate for alloying with the 10 tons of copper to make 11 tons of bronze objects at the cargo’s destination. This estimate has yet to be fully demonstrated; obviously it would take roughly 35 ox-hide ingots of a talent each to provide the desired amount.

A price for tin at Ugarit comes from the same alphabetic tablet, *KTU* 4.337, that provides a copper: silver equivalency. The price is the same as that of copper, 15 shekels per talent, amounting to roughly half a shekel silver per kg (Courtois 1990: 124). Thus, one has 500 shekels’ worth of tin from Uluburun, provided the excavators’ estimate holds.

Gold and Silver

Future scholars will have published weights of all the gold and silver, including the scrap bullion and finished goods to consider. However, the value it will add to the total will likely not be significantly more than what can be estimated today. According to Pulak (personal communication, 3 January 2007), much of the gold and silver from Uluburun has yet to be precisely weighed, but he estimates the 37 individual gold pieces, including divine pendants, a Canaanite depiction of a falcon (KW 94) weighing 12.5 g (Bass 1986: 287–88, pl. 17, fig. 3; Pulak, “Falcon Pendant,” in Aruz, Benzel, and Evans 2008: 355–56), and a scarab inscribed with Nefertiti’s name (Weinstein, “Nefertiti Scarab,” in Aruz, Benzel, and Evans 2008: 358), all amounting to about 530 g or roughly half a kilogram. About half of this figure comes from the 13-cm-high intact chalice, KW 99, which itself weighs about 237 g (Bass 1986: 286, ill. 24; Pulak, “Chalice,” in Aruz, Benzel, and Evans 2008: 353–55).

The price of gold varied widely among the distant corners of the Late Bronze Age world, being far more valuable in Babylonia, for example, than in Egypt, where so much of it was mined. The role of gold in the Amarna correspondence and its temporary status as the *de facto* pricing standard in Middle Babylonian times (Edzard 1960) does not seriously undermine the ability to estimate its value around 1300 B.C.E. During Ramesside times, gold was worth about twice as much as silver in Egypt (Castle 1992: 255). At Ugarit, the price of gold ranged from three to four times that of silver, usually four, as in *KTU* 4.341 (Courtois 1990: 124; Heltzer 1999: 447). Curiously, there are no equivalences from Hatti for either gold or tin (Hoffner 1997).

If one takes a somewhat arbitrary minimum of 0.5 kg for the scrap gold cargo at Uluburun, one has a value equivalent to 2 kg of silver or 213 Ugarit shekels. The gold chalice alone makes up nearly half this amount, though, unlike much of the gold and silver aboard, it was obviously not intended to be used as currency.

Terebinth Resin

Packed into 149 Canaanite amphorae, each about 6 or 7 liters in capacity (avg. 6.7; Pulak 1998: 201), was roughly a ton of resin, identified as belonging to the genus *Pistacia*, and most likely to be identified as *P. Atlantica* (Mills and White 1989; Pulak 1998: 201–2; Serpico and White 2000: 885–86). More recently, gas chromatography of resin found on amphora sherds at Tell el-Amarna, some inscribed *sntr*, and from inside intact Canaanite amphorae at Uluburun have lent support to V. Loret's 1949 hypothesis that Egyptian *sntr* was pistacia or terebinth resin (Serpico and White 2000; Stern et al. 2003).

After the 11 tons of copper and tin aboard the Uluburun ship, the load of resin-filled jars was the bulkiest and heaviest, and one might suspect it was among the more valuable cargoes. Prices for the Egyptian substance *sntr*, here identified with pistacia resin, are unfortunately not known from Ugarit or Hatti, or from strictly contemporary Egypt, but we do have a price of 2.5 *dbn* for 10 *hin* (4.8 liters) from the time of Ramesses VII (1133–1126 B.C.E.). Janssen (1975: 101) hypothesizes that when scribes failed to specify when silver or copper *dbn* was intended, the latter was meant, since prices in silver and gold were rare (Leprohon 2004: 168). If that was so, then the ton of resin was worth a paltry 25 shekels of silver, enough to buy a pair of oxen. If, on the other hand, the figure was meant to be taken as silver, then one has 5,000 shekels' worth of resin and perhaps the most valuable cargo from the shipwreck. Two-and-a-half *dbn* was equivalent to 227.5 g and thus 24.2 Ugarit shekels, making each liter of the substance worth 5 (5.04) shekels.

Whether the resin was valued in copper or silver obviously makes a profound difference—indeed, by a factor of 200—and we have a Ramesside scribe to thank for this unpleasantly conspicuous ambiguity. While I would not question Janssen's reading of Pap. Turin 1907/8, one may question his assumption that the unstated metal must be copper. Castle (1992: 257–64), for example, considers a wide variety of Egyptian texts dealing with trade wherein figures are listed in gold, silver, and copper. Therein it is worth noting that the Egyptian term *ḥd*, whose primary reading is “silver,” took on the extended meaning of “payment” (Castle 1992: 261–62) and at some point became a widely used currency, just as it did in the Near East. In Egyptian records, silver often appears in accounts where either smaller amounts (such as those in copper) are totaled or when more expensive

commodities such as wood are being tallied. This generalization does not help to decide the matter conclusively, but it must be reckoned together with the fact that this was an imported product that was painstakingly harvested only once a year. Terebinth resin was not easily acquired, being tapped in modest quantities, up to 2 kg per tree, in the fall, before being refined and shipped from the Aegean, Cyprus, or Syria-Palestine to Egypt (Mills and White 1989: 43). It thus seems unlikely that a single tree's annual production of resin cost less than a pair of locally made sandals, which never cost more than 1 or 2 copper *dbn* (Kemp 1989: 251). For comparison, one may note that at Old Babylonian Larsa, a liter of cedar oil cost 2.65 g of silver (Van De Mieroop 1992: 158). In Ugarit currency, that would be 0.28 shekels per liter ($2.65 \div 9.4$ g/shekel), over 10 times the Egyptian price in copper but also about 18 times more expensive than the Egyptian price were it in silver. It is perhaps worth noting here that rope and wood were priced in silver (Janssen 1975: 377–80). Tentatively, and hoping for future clarification, I conclude that the resin was priced in silver *dbn* and thus worth closer to 5,000 silver shekels.

Ship Timber (Not Cargo)

Here I must speculate further, since so little timber was preserved at Uluburun. But there was enough to conclude that cedar was used for both the keel and planking of the sunken ship (Pulak 1999: fig. 2), and thus I must consider the value of enough cedar to build a 15-m-long ship of about 20 tons burden. Prices can be very roughly assigned to a mast, the 14 or more strakes needed (7 per side, very conservatively, given the remains), and the keel. For values there is, on the one hand, one poorly understood Ugaritic text that provides the total cost of guaranteeing or building a ship or ships as 540 shekels of silver (*KTU* 4.338; treated by: Pardee 1975; Dietrich and Loretz 1989; Hoftijzer and Van Soldt 1998), a few prices for unidentified woods at Ugarit, and for comparison, Ramesside prices for tentatively identified timbers of largely unknown weight or dimensions.

Unfortunately, there are no contemporary prices positively for cedar since it cannot be identified in Egyptian texts with certainty, and there are no Late Bronze Age prices for it in cuneiform sources. At Ugarit, a shekel of silver bought a log of juniper wood or 12 pieces of pine or fir, indeterminately sized (Stieglitz 1979: 17). Some apparently large logs used in temple construction cost 6 shekels each (Pardee

2002: 101, 3.45Q). One should note that even at Ugarit, where timber was relatively abundant, the price is still high for an unfinished raw material. This will affect my interpretation of the Egyptian prices for imported timber (below).

As Leprohon (2004: 171–72) and Pulak (2001) have noted, the pertinent lumber prices come from the Ramesside papyri interpreted by Janssen (1975: 377–82). These 12th-century B.C.E. texts refer to the imported shipbuilding timber called ‘š, identified variously as cedar, fir, pine, or another conifer. Because documentary and archaeological sources attest to continuous Egyptian exploitation of Lebanese cedar and ‘š from the Early Dynastic through New Kingdom periods, as outlined by Pulak (2001), I would agree with Pulak that ‘š is most probably cedar. A 40-cubit, or roughly 20-m-long, mast cost 4 *dbn* of silver or 38 Ugarit shekels ($4 \text{ dbn} \times 91 \text{ g/dbn} \div 9.4 \text{ g/skl}$), and the same text gives prices ranging down to a 30-cubit, or 15-m, mast at 3 *dbn* or 29 Ugarit shekels. There is no reliable way of knowing if this was a properly sized mast for the Uluburun ship, and the Egyptian sources have masts that vary between 11 and 42 cubits (i.e., 5.5 to 21 m) in length. Keels appear to have cost twice as much, and for a 30-cubit (ca. 15-m) keel, a price of 6 *dbn* is listed (Janssen 1975: 379–80). In Ugarit terms, this item would have cost 58 shekels ($6 \text{ dbn} \times 91 \text{ g/dbn} \div 9.4 \text{ g/skl}$). Besides a mast, at least 14 cedar strakes were used, 7 for each side (Pulak 1999: fig. 2), and this would not account for wasted wood or the number of planks required to constitute each strake. Egyptian planks, literally something like “cut wood” (*iswt*, Janssen 1975: 375–76), cost about 0.25 silver *dbn* each, though we do not have the dimensions of the priced planks. Other texts lacking prices note these timbers reaching 15 m in length only occasionally. In order to build the required 14 strakes from these planks, somewhere between 14 and perhaps 42 (3 planks per strake) would probably be needed. Fourteen of these would run 3.5 *dbn* or 33.9 shekels ($14 \text{ dbn} \times 91 \text{ g/dbn} \div 9.4 \text{ g/skl} = 33.88$), and 42 would run about 102 shekels. Judging from New Kingdom ship depictions (Jones 1995; Wachsmann 1998), the yards for the upper and lower edges of the sail should be even longer than for the keel or mast, at least when joined from their composite parts. None of the parts priced by Janssen have been translated as “yard,” but the most logical choice among the priced ship timbers is the *irkt*, again made of ‘š-wood. Janssen (1975: 378–79) tentatively read this term as “trunk,” which had six *Giornale* instances in the 40–50 cubit

range, exceeding the longest mast known from Egyptian records. The prices are damaged, restored as 10 *dbn* for a 50-cubit, and clearly 5 silver *dbn* for a 45-cubit item. So if one takes only the 5 *dbn* price as secure, we have a likely cost of 10 silver *dbn* for upper and lower yards, or 96.8 shekels’ worth.

Thus, for even the bare outlines of a 15-m ship such as at Uluburun, one might spend close to 400 (392) shekels, though this figure may reflect higher costs of timber in Egypt, far from presumably cheaper sources. Were one to add the joinery materials (pegs and tenons), through-beams, and rope, one would quickly approach the figure of 540 shekels noted in the problematical Ugaritic text, *KTU* 4.338 (Pardee 2002), which appears in this light quite reasonable as a reference to the value of one ship:

540 is the (weight of) silver for ships that went into the ship(s) for the king of Byblos; 50 silver it took the king of Byblos to clothe (put sails on) his ship. 40 silver is the price here.

On Finished Goods

A significant portion of the Uluburun cargo was comprised of luxurious finished goods, most of which cannot be reliably compared to known prices. In general, however, one may observe in available price data how expensive finished goods were as compared with the raw materials they were made of. Metal vessels constitute an especially interesting case, since one can compare their value in weight of metal to the value given the finished good. Prices for finished goods suggest that the cost of labor, especially royally patronized labor, was high and figured into the value of these goods.

As shown in table 2, a heavy bronze basin weighing a talent (an ox-hide ingot’s worth!) cost roughly seven times more than its simple weight in metal. In the same vein but to a lesser extent, a silver bowl described as “a queen’s punch bowl” (*mšq mlkt*) weighed 260 shekels but was valued at 80 shekels gold, equivalent to 320 silver shekels, a difference implying an extra mina for labor and incidentals.

The Hittite Laws give a rough indication of the cost of labor from the production point of view. According to law §160, a man received 50 liters of wheat for the manufacture of a copper ax weighing 2 mina; and §161 states that one earned 50 liters of barley for making a copper ax of 1 mina. For a crude comparison, one may note the Old Babylonian Eshnunna Law that mentions that worked copper costs a

third more silver than raw copper (LE §1; Roth 1997: 59).

Dozens of bronze tools and weapons were recovered at Uluburun, and one might labor to price them only to discover that, in all likelihood, they add relatively little proportional value to the cargo. Pairs of bronze Canaanite and Mycenaean short swords are among the treasures that most probably elude pricing. Unfortunately, the elaborately crafted weapons mentioned in the Amarna Letters, such as the precious stone- and gold-encrusted iron daggers Tushratta gave as wedding gifts to Amenhotep III (EA 22, I: 32–35; EA 22, II: 16–19), are not priced per se, although the weight of gold and silver content was carefully noted. Like the gold chalice and other luxurious items, their value must be seen as related to the status of the intended recipient. Thus, I am likely missing numerous considerable sums in my estimate, not even figuring such organic items as did not survive the millennia.

Wool garments, for example, could be fairly expensive at Hatti, a reflection of the enormous labor involved in the herding, plucking, spinning, weaving, dyeing, and sewing involved in producing 20- and 30-shekel garments listed in Hittite law §182. It was not the wool itself that was so pricey, though. At Ugarit, prices for wool ranged from about 2 to 7 shekels a talent, the price depending on whether it was woven or not and what color it was dyed. Garments at Ugarit, however, were priced similarly to what the Hittite laws show, ranging from a ritual garment costing up to 25 shekels down to others costing as little as 2 or 1 (Stieglitz 1979: 19). So, it looks like most of the cost came at the end of the production process, where fabrics were turned into garments.

Estimated Losses

Among the values I judge unrecoverable at present, the most significant is probably that of the 175 colored glass ingots. This was one of the main cargoes, ranked by quantity after the copper, tin, and resin, but in value per unit of mass perhaps ahead of all else; it was certainly ahead of the Cypriot pottery, given its relatively low value (as estimated by Hirschfeld, noted in Bachhuber 2006: 355). The price of much of the raw material was largely inconsequential, consisting of sand and available minerals, but the cobalt and other coloring additives, labor, technological apparatus required, and probably royally enclaved nature of the industry (Moorey 1985; Nicholson 1995; 2007: 2, 7) imply vast added value. Thus do lapis-colored

ingots appear in Thutmose III's Annals below only gold and silver (Nicholson 2007: 3).

There is, moreover, an entire category of organic, perishable goods, including numerous wet and dry foodstuffs and even narcotics, that at present cannot be valued. On the Uluburun shipwreck, there were remains of "almonds, pine nuts, figs, olives, grapes (or raisins or wine), safflower, black cumin, sumac, coriander, and whole pomegranates, along with a few grains of charred wheat and barley" (Pulak 1998: 210), not to mention other organic cargo that did not survive. Knapp (1991) has discussed the importance of these and other often invisible components in Mediterranean trade. Unfortunately, none of these items can be accurately priced, since we lack either textual evidence for value or an amount that was aboard the ship. The same must be said for textiles, which were almost certainly aboard. Thus, it would be only a wild guess to posit the combined value of glass, ivory, ebony logs, elite weaponry, bronze tools, textiles, and foodstuffs and suggest adding another 50%, or 6,000 shekels, to the total below. This is all a way of expressing the tentative and minimal nature of the total figure I have arrived at, roughly 12,000 Ugarit shekels of silver. I expect this thesis will need modification as new facts come to light from continued study of both the hull and cargoes from Uluburun and perhaps as new texts emerge. There seems enough internal corroboration to argue that the value will only increase beyond 12,000 shekels as new values can be added.

CONTEXTUALIZING THE VALUES

Table 3 lists values for certain goods and services that help put the figures above in more meaningful context. One may be tempted to remark on the relative consistency of some values, such as the price of sheep or slaves, which were about the same all over the Near East. But comparisons are undermined by the small sample of prices for any one region, and by the time gap between archives at Nuzi (15th century), Alalakh (14th century), and Ugarit and Boğazköy (both spanning the later 14th through early 12th centuries). I note well how poor these data would seem to an economic historian hoping to track inflation, national product, mean incomes, etc.

What we have indicates very generally that a worker could make at least a shekel of silver per month, or more if paid in grain, at least where one may expect the redistributing institution to have preferred paying in grain while accumulating metal for its coffers. Such was the case in Egypt, where a com-

TABLE 3. Selected Socioeconomic Indicators, Converted to Ugarit Shekels

<i>Item</i>	<i>Stated value</i>	<i>Source</i>	<i>Discussion</i>	<i>Ug skl</i>
Tribute	12 mina, 20 skl gold	Niqmaddu II to Shuppiluliuma	Beckman 1996, no. 28a	2,500
	(= 500 Hittite shekels)	(<i>PRU</i> 4: 40–44; RS 17.227)		10,000
	50 mina gold	Ugarit to Tudhaliya IV	Beckman 1996, no. 37	3,500
	(= 200 mina silver)	(<i>PRU</i> 4: 150–51; RS 17.059)		
	1 talent 500 shekels	Ugarit to Ramesses II		
		<i>Ug.</i> 5: no. 36 (RS 20.182+)		
Revenue from Mahadu harbor	400 gold	<i>KTU</i> 4.172 (RS 15.093)	Courtois 1990: 126; Stieglitz 1979: 20	1,600
	400 gold	<i>KTU</i> 4.266 (RS 17.074)	Courtois 1990: 126; Stieglitz 1979: 20	1,600
Male wages	1 skl/mo.	Hittite Laws §150	Hoffner 1997	ca. 1
	4 khar ^a (308 liters) emmer +	Ramesside Egypt	Leprohon 2004	2.5 + 0.23 /mo.
	1 khar barley per mo.	(Janssen 1975: 460–66)		
Foremen, scribe wages	5.5 khar (423.5 liters) emmer + 2 khar barley per mo.	Ramesside Egypt (Janssen 1975: 460–66)	Eyre 1987: 178	3.4 + 1.23 /mo.
Female labor	0.5 skl per mo.	Hittite Law §150	Hoffner 1997	0.625
Slave	10–120 (33 norm)	Ugarit	Heltzer 1999: 445	33
	20–40	Nuzi	Heltzer 1987: 247	avg. 25 ^b
	10–38	Hittite Laws §176, 177	Hoffner 1997; Heltzer 1987: 247	avg. 33
	25	Alalakh	Heltzer 1987: 247	25
	40 (“cupbearer”)	Amarna (EA 369)		40
Ox	10 skl	Nuzi	Cross 1937: 62	8.33
	12 skl	Hittite Laws §178	Hoffner 1997	15
	10–17	Ugarit	Heltzer 1999: 446	avg. 13.5
Donkey/mule	6.67 skl	Nuzi	Cross 1937: 62	5.55
	40	Hittite Laws §180	Hoffner 1997	50
	10–30	Ugarit	Heltzer 1999: 446	avg. 20
Sheep	1.33 skl	Nuzi	Cross 1937: 62	1.1
	1 skl	Hittite Laws §179	Hoffner 1997	1.25
	1–1.5 skl	Ugarit	Heltzer 1999: 446	avg. 1.25
Horse	30 skl	Nuzi	Cross 1937: 23	25
	14–20 skl	Hittite Laws §180	Hoffner 1997	avg. 21.25
	35–200	Ugarit	Courtois 1990: 125	35+
Barley	4 Hittite parisu (200 liters)/skl	Hittite Laws §183 (še restored)	Hoffner 1997	0.003/liter
Wheat	3 Hittite parisu (150 liters)/skl	Hittite Laws §183	Hoffner 1997	0.008/liter
	1 Ugarit parisu (90 liters)/skl	Ugarit	Heltzer 1999: 445	0.01/liter

^a Janssen (1975: 108) gives 76.88 liters per khar for the period from Ramesses II through Ramesses V. I have rounded it to 77 liters/khar.

^b Nuzi shekels were 5/6 or 0.833 times the size of those in the Levantine standard. Thus, it is not surprising to see the average price of 30 shekels at Nuzi match the price at Alalakh, when converted to the Syrian-Levantine standard. Likewise, the mean Hittite price 26.5 matches the norm at Ugarit when converted by factor of 1.25.

mon worker earned a quantity of cereals each month equivalent to nearly 3 shekels silver, and more skilled employees, the managers, and bureaucrats took home over 5 shekels silver worth of wheat and barley each month. Thus, from the common man’s perspective, the Uluburun shipment would be hard to imagine: a thousand years of salary, or more wealth than one might earn in many lifetimes. It might be easier to

think of 12,000 shekels as the yearly payment for the thousand workers populating a large town. The copper alone would have purchased at least a 350-head herd of large cattle or many such herds of sheep, more than enough to sustain a large community; indeed it may not be coincidental that each ox-hide ingot was worth roughly the price of an ox at Ugarit, about 15 shekels silver. A sheep seems to have been

worth about a month's wages and would have constituted a source of wealth (in meat, dairy, and wool) familiar to anyone. Thus, if one were to reduce the significance of the Uluburun shipwreck to counting sheep, one sees the potential life blood of 12,000 families lost in a single catastrophe. Likewise, an overland trader might look at the sum as the equivalent of 600 donkeys, or a *maryannu* (member of the elite charioteer class) as 400 horses. Population estimates for Ugarit are tentative, averaging out to around 8,000 people for the walled urban setting, but for what they are worth, 12,000 shekels again looks like enough to feed much of the city for a year.

Of course, Ugarit was not just an agrarian, pastoral "cow town," and many of its urban dwellers would have been accustomed to seeing large sums of wealth. Though not equivalent to an annual tribute, the 1,600-shekel amounts recorded in two Ugaritic texts are interesting if they are correctly understood as being revenues from the port town of Mahadu. These are large sums—unfortunately not explained by the tablets as to the duration or specific sources of this income, but we can start to imagine how the taxing of Uluburun-sized shipments could add up to such figures. A modest 10% duty on just our shipment would amount to over 1,000 shekels. Thus, it was more than a nominal gesture when the king of Ugarit released Sinaranu the ship owner from taxes on his Cretan imports (Hoftijzer and Van Soldt 1998: 340 [PRU 3: 107, pl. 59]), or at least, as Knapp (1991: 37) emphasizes, on the grain, ale, or oil.

Most studies of the Uluburun shipwreck make at least a tentative connection between its lost treasure and the royal gift exchanges evinced by the Amarna correspondence. As I have quantified it, the Uluburun cargo is certainly not inconsistent with this interpretation. Indeed, it is hard to avoid the expression "king's ransom" in attempting to convey the scale. Perhaps the expression is apropos, since my total is nearly five times what Niqmaddu II paid "Great King" Shuppiluliuma in yearly tribute to retain Ugarit's dynastic independence in the later 14th century (PRU 4: 40–44; Beckman 1996: no. 28a), this over three times greater than the tribute Ramesses the Great imposed on Ugarit in the 13th century (Ug. 5: no. 36), and even greater than the enormous 10,000-shekel tribute Ugarit paid to Tudhaliya IV (PRU 4: 150–51; Beckman 1996: no. 37).

Considering these figures, it becomes possible to roughly gauge the impact of loss, despite the lack of contemporary documentation for shipwreck losses. One finds virtually no such commentary from antiquity,

save for the cost in men and ships lost in war. A search for mercantile parallels takes us to the 10th-century C.E. Persian Gulf where two towns collapsed not long after a three-ship merchant fleet was lost while taking goods from one town to the other (Hourani 1995: 118–20). Was a Bronze Age merchant house, prince, or even town ruined by a sailor's mistake at Uluburun? I could not say, except to note that the possibility highlights the importance of spreading risk broadly.

I do not see the enormous value or risks as being a *de facto* confirmation of the royal shipment hypothesis—specifically, that the ship, cargo, and crew were owned by the crown. Unfortunately, the price data offer little direct evidence on matters of organization. One assumes that kings of Ugarit owned ships, though it is rather flimsily attested in royal correspondence which habitually makes overgeneralized claims of ownership, whereas there is ample proof that private citizens of the realm did. I see it as more likely that a "royal shipment" such as the one lost at Uluburun was carried out by a merchant house/firm doing business for itself and the crown. Such a house would possess generations of maritime talent and be well positioned to fulfill royal orders. It would also be more capable of sustaining such a catastrophic loss if the costs of cargo and even that of the hull were divided among extended family, members of the firm, and other stakeholders.

Indirect evidence for this kind of traditional maritime insurance is provided by a single, well-known Akkadian legal text from Ugarit wherein the harbor-master swears that a foreign captain intentionally ran his ship into the quay (Hoftijzer and Van Soldt 1998: 340–41 [PRU 4: 118–19]; Beckman 1996: no. 34). That boats were rented (as in Codex Hammurabi [CH] § 277) also shows some intention to recover or avoid the more gradual kind of sunk costs dealing with the depreciation and eventual replacement of watercraft. Though we have little means to judge how much of a catastrophic loss would be recoverable, a prudent merchant would have planned for it by assuming something similar to the notion of sunk costs, i.e., recognizing that certain expenditures (ship-building being a major one), would have to be offset by maximizing profits on buying and selling. Planning for the worst in this case would mean figuring the total loss of ship, crew, and cargo as a sunk cost. Merchants able to cover this "ultimate sunk cost" would already have achieved a certain level of wealth, a testament to their skill in avoiding past catastrophes. A merchant like Sinaranu, having reached the highest level of commercial success, could probably

have built a new ship from the taxes saved on a shipment or two just like the one that sank off Uluburun.

CONCLUSIONS

Given the ambiguous nature of the evidence and the comparative, heuristic method just employed, working hypotheses and suggestions can be made here, but hardly conclusive ones.

Arriving at a minimum price tag, even one based on Late Bronze Age notions of value, does not solve the more intransigent issues concerning identity, ethnicity, or political economy that trouble our interpretations of the Uluburun shipwreck. It might be tempting to conclude, for example, that the Uluburun mariners were agents of a palace. The quantities and values of copper, tin, and glass, plus various unpriced finished goods, some of which were royally enclaved, or “de-commoditiz[ed] from above” (Appadurai 1986: 22), certainly do not argue *against* such a thesis. However, even if the value of the shipment were twice, thrice, or exponentially greater than suggested above, the organizational procedures of royal shipments would still be hidden from us; nor would the socioeconomic lives of seafaring merchants have been revealed. As I have argued extensively elsewhere (Monroe 2009), the relationship between palace and merchant in this setting is likely to have been less patrimonial and more symbiotic than is implied by conventional paradigms of authority and control. Limitations of the gift exchange model have been noted for some time (Zaccagnini 1987: 58), and Knapp (1991: 51–52) has long called for an approach to trade that better accounts for the balanced interests of rulers and merchants. More complex and less centrally documented, the liminal role of maritime folk demands a holistic approach to the available artifactual and documentary evidence that works toward defining social relations of exchange; the more archaeologically salient phenomena of demand and production should be analytically balanced so as to avoid being overly determinant. Relying too much on the Amarna correspondence, or the palace archives at Ugarit, or on a unifying structural social model is bound to lead toward a royal conclusion, one that can form only part of a broader picture. Parts of this puzzle become apparent by focusing on the market—not the physical marketplace, but the information network concerning goods and their values whose reach was influenced by, but not limited to, the royal sphere (Snell 1997: 158).

It is difficult to resist identifying a prime mover behind such conveniently encapsulated evidence for

trade as found in a sunken shipment. As illustrated by Bachhuber’s (2006) critical approach to archaeological indicators of identity at Uluburun, serious impediments to the task may lead to many negative conclusions. A complementary approach might focus on the already conspicuous intercultural aspects of the shipment and accept as a working hypothesis that the heterogeneous crew and cargo derive from a heterogeneous cultural and socioeconomic setting that may defy structural categorization. The question would then shift from the where, whence, and by whose order to more investigation into the selection criteria underlying a particular mixture of cargoes and/or crew’s possessions. This may be a matter for maritime archaeology to mud-wrestle with, while others take such illumination from Uluburun as they can, whether it shines on the Mycenaean, Levantine, Egyptian, or other worlds studied for their own sake. Whatever cultural context one situates the shipwreck within, it seems fair to suggest that we must keep asking and refining the question of who could amass such capital and also assume the risks for sending it overseas and between those familiar contexts.

While aware of various interpretive perils, I would suggest that a venture of Uluburun’s scale could have been organized from within a socioeconomic class of maritime entrepreneurs such as defined in Monroe (2009: ch. 7), one whose social relations and means of exchange, while laconically preserved, extended beyond the palace. Hardly case-specific, the challenge of defining an underrepresented social group is one continuously faced by maritime archaeology (Flatman 2003), and this is especially true regarding Bronze Age seafarers. Quantifying the value of the shipment resolves little about where the ship was headed, who sent it, and who financed it. Thus, my findings neatly join with many conclusions reached about Uluburun, the problem being that they all add up to something sounding a bit like, “we know a lot more now about some people we still know very little about.” Until such knowledge crosses the threshold of satisfaction, it may be productive to accept such ambiguities and liminalities that maritime culture presents and resist confining it within overly rigid models. Whatever its value, Uluburun will likely remain “maddeningly eclectic” (Wachsmann 1998: 330) for some time, not only in its material heterogeneity, but in the variety of interpretations it attracts. This persistent annoyance may have to be written off as an acceptable sunk-cost of doing archaeological business with shipwrecks.

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