Originalveröffentlichung in: The Journal of Oman Studies 20. 2019, S. 143-176

Defence during the Samad Period – A First Attempt at an Archaeology of Conflict in South-eastern Arabia

Paul Yule

ABSTRACT

The presentation of Samad Late Iron Age (LIA) weaponry made in the final field-work report in Samad al-Shān of 2001, for different reasons was hardly received in the specialist literature. A main reason is its publication in German language. Another is the fewness of students of this period in south-eastern Arabia. Despite the modest state of research for this period/assemblage in central Oman, an update which focusses on defence in general is worthwhile and the material relatively abundant, even compared with a more intensively researched contemporary assemblage (Pré-Islamique Récente, e.g. Mouton, 2008), centred mostly in sites located in the United Arab Emirates.

KEYWORDS: Samad Late Iron Age, South-eastern Arabia, Oman Peninsula, Conflict Archaeology, Pré-Islamique Récente.

الدفاع خلال فترة سمد - أول محاولة لدراسة آثار الصراع في جنوب شرق الجزيرة العربية

بول يول

الملخص:

لأسباب مختلفة لم يكن عرض أسلحة فترة سمد من العصر الحديدي المتأخر (LIA)، والتي قدمت في تقرير العمل الميداني النهائي في سمد الشان لعام ٢٠٠١م، مستقبلاً بشكل جيد في الأدبيات المتخصصة. ويعود السبب الرئيسي في ذلك إلى نشره باللغة الألمانية، إضافةً إلى قلة عدد الطلبة المتخصصين في هذه الفترة في جنوب شرق الجزيرة العربية. وعلى الرغم من الحالة المتواضعة للبحث في هذه الفترة/المجموعة في وسط عمان، فإن التحديث الذي يركز على الدفاع بشكل عام أمرٌ مفيد، كما أن المادة وفيرة نسبيًا، حتى بالمقارنة مع مجموعة معاصرة معها تمت دراستها بشكل مكثف (فترات ما قبل الإسلام الحديثة (Pré-Islamique Récente) انظر على سبيل المثال Mouton 2008)، والتي يتركز معظمها في مواقع تقع في دولة الإمارات العربية المتحدة.

الكلمات المفتاحية: فترة سمد من العصر الحديدي المتأخر، جنوب شرق الجزيرة العربية، شبه الجزيرة العمانية، آثار الصراع، فترات ما قبل الإسلام الحديثة.

INTRODUCTION

Warfare dominated antiquity and pre-Islamic Arabia for individuals and polities. Till now for south-eastern Arabia what little has been published about this topic, usually departed from a standpoint of the origin of certain weapons (e.g. Potts, 1998; Yule, 2001 I:197-200; Mühle, Schreiber, 2011). A. Beeston's study of warfare in ancient south-western Arabia of 1976, conceived of for all of Arabia, completely lacks knowledge of archaeology. After several years, understandably, this literature must be updated. Although we cannot date even a single Late Iron Age (Samad LIA: post 300 BCE-300 CE) military engagement, the wealth of newly excavated weapons provides 'smoking gun' evidence for attack and defence as basic occupations. For the EIA there is even less data pertaining to defence. A revived interest in the warfare of the distant but still influential Greco-Roman world has resulted in new synthesizing historical and historiographic works (e.g. Sabin et al, 2007) as thinking models. In south-eastern Arabia inhumation burials form our most plentiful type of evidence. Virtually all use them widely for inferences about past societies. Graves have been particularly useful in European archaeology for interpretation in terms of social organisation, i.e. the wealth, status and roles of individuals, and the structures of communities (Härke, 1997:19). Gender and status have been a major issue in archaeological debate for over four decades - but rarely in south-eastern Arabian archaeology. World archaeology has generated vast amounts of new finds and literature (e.g. Association for Roman Military Equipment Studies) which impel one to reflect on armed conflict also in LIA south-eastern Arabia. All fields of science require a detailed order and prehistory is no exception. This order or classification of archaeological materials is a prerequisite for the scientific analysis. An essentially unstructured material is converted into an essentially structured one. It is first with the classification that the archaeology achieves an adequate overview of the variability of the material to be analysed (Eggert, 2001:122).

Sources known from a 200 year research tradition for the Mediterranean region based on texts, inscriptions and archaeology dwarf that of south-eastern Arabia which began in the 1980s. Understandably, the latter are far less tangible. Whatever deficits this Arabian archaeological subfield might have, the Samad LIA offers the advantage of having single burials as a main source which leads to a good differentiation of women's and men's burial customs – not prone to multi-period use and re-use disturbances. It is fair to state that for the field of the LIA, Oman in recent years suffers from a lack of both goal-oriented archaeological research for the LIA and of meaningful dialogue. The disadvantage of conference communications is that they are conceived for a single speaker and not a discussion. Another serious monus is a lack of archaeologically reliable contexts. Characterisations regarding the archaeology of central Oman which depart from the vantage point of the archaeology of the neighbouring United Arab Emirates are unsuccessful because the archaeological assemblage there, the période pre-islamique récente (PIR) shares both similarities but also differences with the Samad LIA. Also, the PIR has benefitted from far more research than has the Samad LIA. My own revised patchwork chronology for the latter period, unfortunately without the benefit of radiocarbon (Yule, 2016:65 Fig. 31), can easily change by means of even a small new project.

Given the poor preservation of most archaeological contexts in central Oman (not to omit their attrition as a result of present-day population growth), to a large extent interpretation relies on models and hypotheses. Despite the enormous investment in building elaborate stone tombs and their importance to their owners, we can say little about the latter. It is easy to question the integrity even of the artefactual definition of the Samad archaeological assemblage, based on only 200 published graves from central Oman Samad LIA, which I myself do. Originally, cemetery S10 was believed to contain over 1000 graves which during surface excavation in 1982 proved to be far fewer. More commonly authors simply ignore these data. While in central Oman this period is the one least researched, it is hardly the least interesting one. One

The National Survey Authority is not responsible for the spelling and correctness of the names of archaeological sites beyond the borders of the Sultanate.
Due to the request of the Ministry of Heritage and Culture to add some names of archaeological sites in the Sultanate, it is the ministry responsibility to ascertain the accuracy of these names.

Figure. 1: *Most Late Iron Age sites in south-eastern Arabia are grave sites. Triliths are not attributable to the Samad LIA, but a few appear here. State: 13.02.2019.*

reason for the paucity of discussion results from the fewness of committed students and colleagues; the discussion culture regarding this topic is little developed, in part a result of the weak material base. However, as once put, '…the Samad assemblage represents the contemporary settlement in this vast region, and it cannot be ignored' (Mouton, Schiettecatte 2014:77).

THE SETTING

The pre-industrial climate and water resources of Oman sustained one of the thinnest populations on the earth, to judge from pre-industrial censuses. In 1913 it was estimated to be 500,000 (Lorimer, 1908:1411, 1412), using the area measurement of the Sultanate at that time (309,500 km2). The population amounted to 1.61 persons/km2, a tiny fraction of today's density. As in recent pre-oil Oman, one assumes a very high mortality for children up to the age of five. Until recently, central Arabia shared this meagre density with Oman. Nominally held to be Bedouin (badawī) in economy, in reality most of the Samad LIA population more likely were ḥaḍarī, settled mostly in watered oases. Although this dichotomy may be over-simplified (Wilkinson, 1987:94-95, without taking advantage of archaeology for his re-construction) for central Oman, the concentration and kind of graves at Samad and al-Moyassar suggest the LIA population, as we know it, to be a settled one. First, the graves decidedly imitate permanent dwellings rather than tents. Nor has one encountered earth burials, as one might expect from the Bedouin. The diet of the Samad LIA population is that of settlers, not Bedouin, especially to judge from the occurrence of caries from the date staple (cf. Rosenzweig, 1968; Kunter, 1983:339, 341; Yule, 2018b).

The LIA of central Oman appears distributed over a core area of some 17,000 km2 (smaller area than of neighbouring Kuwait), by virtue of graves with infra- and intersite shared common artefacts (Yule, Pariselle, 2016:153). Anthropological diagnoses from graves here identify the skeletons of both sexes and of different age groups. The main weapon-users appear to be males c. 16 years of age or older (Yule, 2018b).

A few general observations regarding the economy: that nomads, semi-nomads and settlers mostly were tribally organised in LIA Arabia generally is taken for granted. The settlers required the Bedouin for trade and the Bedouin the settlers as a market and a source for agricultural produce. While Oman offered certain natural resources, the little-understood LIA economy does not appear to have exploited all of them, as did its predecessor (e.g. copper mining and smelting). Main reasons for the poverty of this period may lie in unfavourable climatic developments, insufficiency of water and other basic resources, social turbulence and a lack of exports (summarised in Yule, 2013b:2-3 for all of southern Arabia). For the Samad LIA one can question if the falağ is the rule or the exception, since only one is really proven at that time (site M46, Yule, 2017).

In LIA central Oman, alone the environmental resources, tribal structure, lack of an urbanoid centre, and thin population preclude elaborate forms of social and military organisation known from other parts of the ancient world. A lack of roads need not be a logistical problem for Bedouin raids and the Azd tribes somehow arrived in Oman without them in the first place: however, the enormous logistical infrastructure e.g. of the Neo-Assyrian, Neo-Babylonian, Achaemenid, Greek, Roman or Sasanian states, with large, even standing armies, is implausible in our region, if for no other reason than owing to the tenuous population. On the other hand, Arabian tribal organisation is textually well-documented, and defensive units can only have cleaved along tribal lines. Our understanding of the means to wage war and defence is limited by the parameters set by this social organisational potential. On present data, instead of cumbersome siege machines, Roman legions or Greek phalanges, we will have to accept the irregular lightly armed tribal militia as the basic military form in south-eastern Arabia at this time. Its form adapts from available resources and is a response to the overall defensive military situation there. Most important in the question of defensive strategic parameters is

the economic base of the population. The central part of Oman is largely without water resources and isolated from the rest of Arabia. Metal weapons were rare and expensive. It can hardly be expected that there was any way to unify basic aspects of weaponry and strategy at this early date.

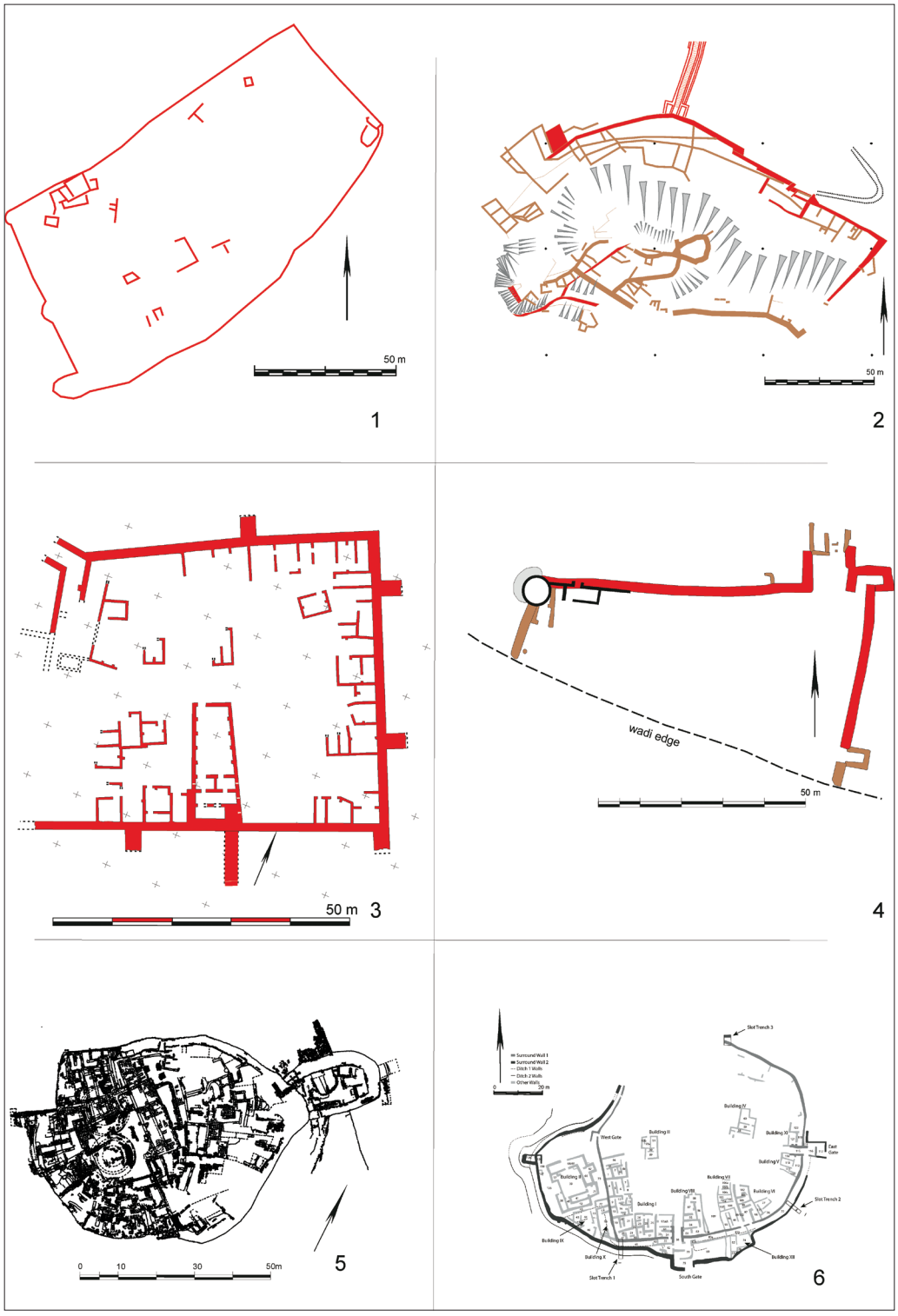

Figure. 2: *Selected EIA forts: 1 Fiẓḥ 2. 2 Lizq L1, 3 Hili H14, 4 Ḥuṣn Awhala, 5 Salūt, 6 Muweilah.*

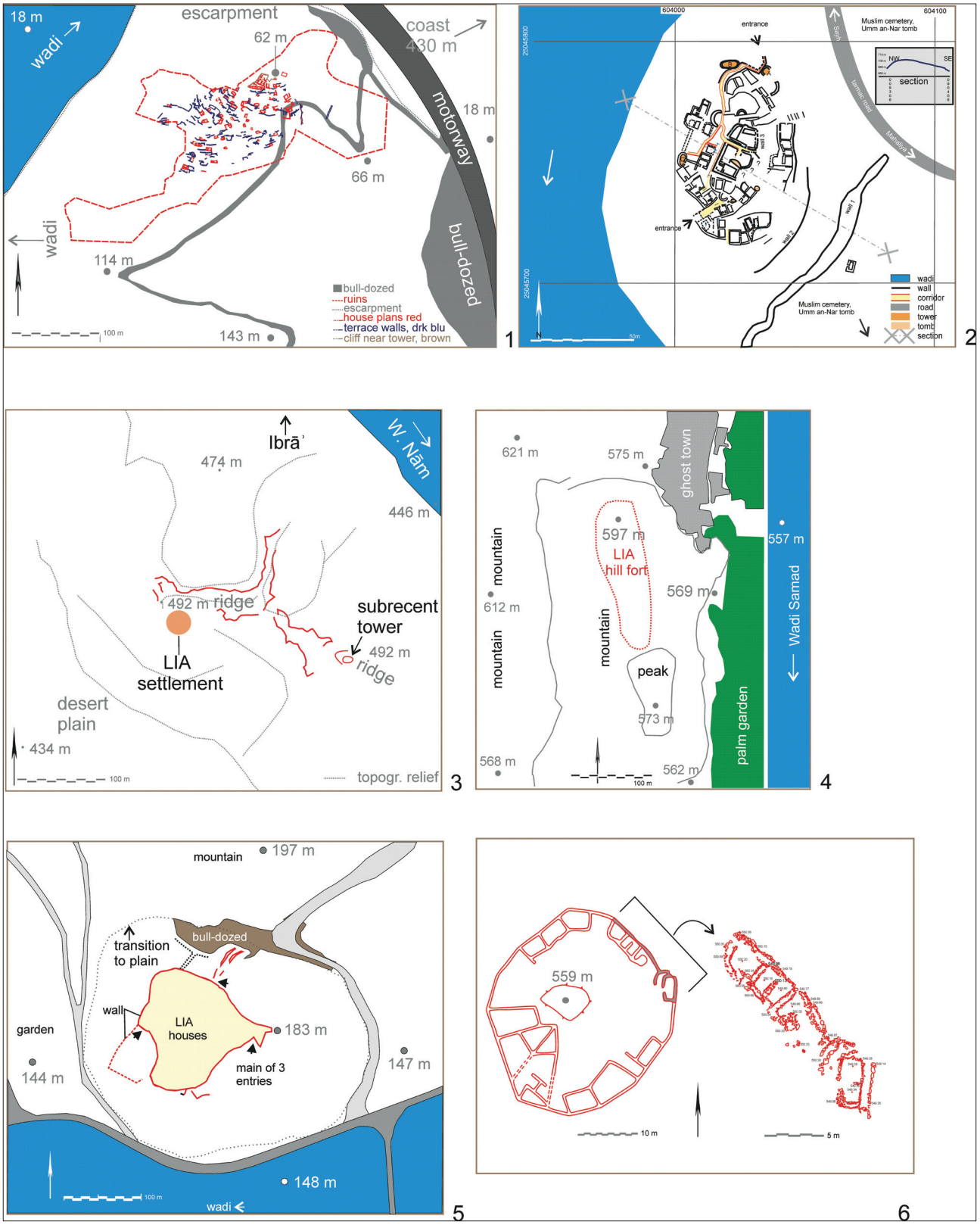

Figure. 3: *Known LIA forts and fortified settlements in central Oman. 1 Ṭīwī TW2; 2 Maḥram/Qariyat al-Saiḥ; 3 Alāyat Ibrā'/al-Qanāṭir I52; 4 Samad S1, 5 al-'Atqiyah/J. Ṣunṣunah; 6 al-Moyassar fortlet M34. Different scales.*

Table. 1: *Comparison of EIA and LIA forts and fortified settlements shows both had to adapt to a variety of different survival situations, such as interior area and wall thickness.*

no.	place	EIA	LIA	wall th.	literature
1	Fizḥ 2	10500 m²	-	c. 1.5 m	Costa-Wilkinson 1987, 105; Yule 2014, 36 Fig. 14.1
2	Lizq L1	20000 m²	-	1 m	Kroll 2013, 195 fig. 33
3	Hili H14	>3000 m²	-	1.5 m	Boucharlat-Lombard 1985, pl. 67
4	Ḥuṣn Awhala	>3500 m²	-	4 m	Petrie 1998, 248 fig. 2
5	Salūt	4500 m²	-	max. 2 m	Avanzini-Phillips 2010, 98 fig. 8
6	Bithnah 24	5500 m²	-	1 m	Benoist et al 2013, e.g. 43 fig. 12
7	Muweilah	8000 m2		2 m	Karacic et al 2018, 29 fig. 2
8	Ṭīwī TW0002	-	42900 m²	-	Korn et al. 2004, 70 fig. 4
9	Ibrā' I00052	-	16500 m²	1.5 m	Schreiber 2005, 260 fig. 7
10	J. Ṣunṣunah	-	16200 m²	1.3 m	Yule 2016, 59-60 Fig. 20
11	Qaryat al-Saiḥ	-	4000 m²	1 m	Yule 2016, 63-4 Fig. 30
12	Samad S1	-	1600 m²	0.9 m	Yule 2016, 62-3 Fig. 27
13	'Umq al-Rabaḫ	-	-	-	Yule-al-Rasibi 2015
14	al-Moyassar M34	-	1000 m²	1 m	Yule 1999, 129 Fig. 7
15	ed-Dur F	-	900 m²	1.5 m	Mouton-Schietteatte 2014, 68 fig. 56
16	Mlayḥa CW	-	1600 m²	2 m	Benoist et al. 2003, 60 fig. 2
17	Mlayḥa H	-	900 m²	1 m	Mouton et al. 2012, 208 fig 4

IRON AGE FORTIFICATIONS

Aside from the documented Early Iron Age (EIA) Ḥuṣn Salūt, Muweilah and less so Lizq L1, what little we know about IA forts amounts to recent accidental finds known from find notices (especially Yule, 2016 with site photos). Within both the EIA and LIA and compared to each other, fortifications in south-eastern Arabia are heterogeneous in shape, size and details of construction, and reflect purely local solutions to defence challenges. Whereas EIA fortifications may be dependent on the aflāǧ (e.g. Salūt and Hili H14), the known Samad LIA fortified settlements are built beside wadis (exception: al-Moyassar M34). No pre-Islamic unfortified military camps have yet been identified in Arabia, such as those numerous in Roman Europe. The fortification builders were unaware of the siege methods of the west (Breton, 1994). For example there is no evidence of circumvallation, as at Roman and Sasanian Hatra, Lilybaeum, Sicily in 250 BCE and Capua, southern Italy in 212 BCE (Sabin, 2007:424). Nor is there any for siege-tunnelling.

Muweilah, with walls and trenches, has the most developed defences known during the EIA. Trenches combined with walls are not unique in south-eastern Arabia, however. They also came to light at Tell Abraq (Magee et al, 2017:210 fig. 2) and Kalba (Carter, 1997:fig. 15, section 42 east; pers. comm. S. Karacic). Trenches in Um An Nar period towers also can be understood as defences, or otherwise (Döpper, 2018:126 fig. 7). Such structures are to be expected, even if few are rarely well-documented. However, no forts of the IA are suitable to accommodate chariots, an indication that they did not exist in this region. A copper alloy phiale from ed-Dur shows a chariot which the artist has completely misunderstood (Overlaet, Yule, 2018:175 Fig. 3). Aside from Muweilah, with baffled entrances and defensive trenching, the

most elaborate yet to be documented (e.g. Karacic et al, 2018:33 fig. 10), the preservation of the fort entrances in our region is generally poor (Figs. 2.1-4, 2.2, 2.5-6) - the most important part of the defence for the attacker and defenders. In the EIA walled open settlements such as Fizḥ 2 (Fig. 2.1) and Bithnah 24 are rare (Benoist, 2013:41 fig. 10; heidICON, SKVO "Oman": Bithnah 24). Fizḥ may have been full, like Muweilah, of dwellings. EIA Salūt is a walled settlement which defends itself and its recently discovered surrounding settlement (pers. comm. M. Degli Esposti).

The geometric regularity of the EIA Hili H14 plan contrasts all others, except those of the subsequent PIR in the Emirates (e.g. Mlayḥa forts CW and H, Mouton, Schiettecatte, 2014:60-1 figs. 47, 49). Only Salūt and Lizq L1 have a heavily walled external keep, perhaps to protect a well. Such gates are not nearly as effective as those from Iron Age Mesopotamia (Reade, 2016). The PIR Mlayḥa CW and H forts as well as ed-Dur fort in area F (Mouton, Schiettecatte, 2014:68 fig. 56) are far more regular in shape than any from the central part of Oman.

As at LIA 'Umq al-Rabaḫ (heidICON, key word: Umq al-Rabakh)1, in the field some sites are nearly impossible to even recognise as a fortified or to re-construct the perimeter wall on paper (Yule, Rasibi, 2015). The plan of the LIA fortified settlement, Ibrā' I52 is difficult to understand for preservation reasons and its 3 m high defences seem to flank both the north and south sides of a mountain crest (cf. Fig. 2.3 with Schreiber, 2005:260 fig. 7). The settlement itself lies some 15 m to the south of the crest. Clearly, strategic considerations include a nearby source of water and a defendable position. Samad LIA fortified settlements do not correlate with mining assets. For the EIA, this aspect needs further research.

The largest of these LIA fortified settlements, Ṭīwī TW2, hides behind the cusp of a volcanic crater wall, and was hardly visible below from the coast (Fig. 2.1). Immediately after being worked on in 2002, this site was thoroughly plundered of its stone and vandalised by bull-dozing (Yule, 2016:60-1) which compromises its value as a source. The use of room-walls inside the exterior walls in LIA central Oman appears to be a novum, as at J. Ṣunṣunah and M34 (Figs. 2.5-2.6), but is known from contemporary outside sites, e.g. Masada in the mountains of Judea. Basic descriptions for a comparison of the IA forts appear in Table 1. The Samad LIA defences seem to use wadi and natural stones, whereas the EIA defences such as Lizq L1 (Kroll, 2013:199-201 Figs. 37-39) use more worked stone and mudbrick. The surface area and outer wall thickness of each fort vary considerably. Unusually proportionately thick are those of Ḥuṣn Awhala (Fig. 2.4, Potts et al, 1996), which may have been re-enforced in the sub-recent period. In both the Early and Late Iron Age large, stout fortifications existed, but also small ones.

Although fortified settlements are essential for the LIA survival strategy, in no way do they improve on forts of the preceding period. Aside from this, hilltop fortlets such as M34 or S1 (Figs. 3.6 & 3.4), with walls perhaps little more than 2 m in height were only temporary havens against razzias for a few hours or days. Large, well-designed EIA forts, over 3000 m2 in surface area, require a central organisation for their building. Like the others, the large LIA settlement on the J. Ṣunṣunah owes its size ultimately to accumulations of agricultural surpluses to enable such building projects. Perhaps best-preserved is the LIA settlement at Qaryat al-Saiḥ which was built over in the sub-recent period (Fig. 2.2). None of these LIA settlements preserve recognisable traces of violent destructions. Given the poor preservation conditions, these would require considerable research resolve to identify. For example, mud brick has survived badly, except at H14, Salūt and at Um An Nar al-Moyassar M25 (Weisgerber et al, 1981:203 Abb. 32) where at least a plan is recognisable. A sudden destruction only seems plausible with the EIA fort Lizq L1, as the excavators in fact interpreted in the blocked off upper defences (Kroll, 1981:228). On the whole striking is the fewness and relatively small size of the defences, a reflection of the thin population which needed them.

1 heidicon.ub.uni-heidelberg.de , the pool SKVO "Oman".

DEFENSIVE ORGANISATION

Relevant Sabaic inscriptions lie far away in south-western Arabia which leave no doubt about the constant state of warfare in neighbouring south-western and central Arabia (Beeston, 1976; Schippmann, 1998:91-6; Yule, 2001 I:197-200). The Bedouin habitually fought and fighting became a function of society (Khadduri 1986:180). War (ḥarb) fulfilled purposes such as vendetta and retaliation. Payment of diya in the case of homicide or other injuries may take the form of money or goods (Tyan, 1991:340). This may partially explain the lack of combat injuries in the Samad LIA skeletons excavated. Diya was originally a pre-Islamic institution bound up with the tribal organisation of Arabia. It is a substitute for the law of private vengeance. Raids hardly evoke the image of frontal attacks to counter a frontally attacking opponent. Raids provoked counter-raids.

Models for the mentality of the village warriors derive in part from Arabic texts which are rooted centuries before in the jāhiliyya. A key factor in our discussion of warfare models is the meagreness of the LIA south-eastern Arabian population density. For northern Arabia we learn about the tenor of the times from the ayyām al-'Arab (the battle days of the Arabs, recently, Toral-Niehof, 2014). There is a pre-Islamic code of honour, ethics or manners known as murū'a for war and warriors (eds, 1993).

Usually taken to be a main source, the difficult Arabic oral history kashf al-ġumma (Ross, 1874; Klein, 1938; Sālimi, Tuḥfa) recounts, as a result of being barked at by a dog, Mālik bin Fahm's Arab tribe depart from the Yemen to Oman with 6,000 cavalrymen and infantrymen. They settle in Oman's al-Jawf (between Salūt in the interior and Qalhād on the coast), take up battle with the Persian 'Marzuban… Dárá bin Dárá bin Bahmān ibin Asfidiya' and his troops, who they vanquish (Sālimi, Tuḥfa 21). This information does not jibe with what is known of the archaeology of the period, since the LIA around the EIA Salūt fort (Fig. 1.5) is represented by only a few graves - assuming that the burials found there represent the population mentioned in the kashf. This oral history seems not to refer to the Samad population, which centres some 100 km to the ENE of Salt. Nor does it have any real knowledge of the jāhiliyya. As expected in such heroic accounts, the small Azdi army vanquishes the far larger 'Persian' (Parthian or Sasanian?) force. None of the mixed Persian personal names or titles in the kashf are historical but rather are somehow Persian-sounding text-building stones. A 'Persian' army of '30000 - 40000' is implausible in Oman, since it poses insuperable logistical problems. Also the use of combat elephants (cf. Bosworth, 1986:194) is unlikely and too expensive for Oman, notwithstanding their use in other parts of the ancient world. Persian military goals in Oman could have been reached with a far more modest force, as in the case of Khosroe's I (531-79 CE) invasion of the Yemen or Portuguese attacks on Oman, carried out partly with local mercenaries (Yule, 2001 I:182).

In the Samad LIA one hardly expects planned frontal battle formations and battle plans, but rather asymmetric spontaneous actions. We have to think in terms of razzias and single combats, the fending off of such and at al-Moyassar the temporary use of fortlets such as M34 as main modi of attack and defence. The basic defence situation for the Samad settlers must have been waiting and watching, possibly from towers, for marauding mounted groups of Bedouin to attack, to judge from historic times. Admittedly none of the towers, which dot today's landscape, is datable to the LIA. Conflicts between tribes brought all able-bodied men into action, but without military organisation, combat was often settled by individual feats of arms (Cahen, 1991:504).

Despite poor communications, the LIA defenders had to react to a razzia instantaneously. Razzias might take place within a few hours or extend a few days, rarely weeks, although feuds persist over decades. While defenders might retreat to a fortlet, the attacker could take his time plundering the shady oasis gardens. Ghazis or murabiṭūn are not battles, but rather sudden raids which on the way back are delayed by transporting the booty which consisted of livestock (Cahen, 1986:183). Pitched battles were risky and probably relatively rare. Besieging a fort could bind large numbers of opposing troops,

and are thus expensive. Greek and early Roman opposing forces often were aware of one another's presence and could take steps to prepare for or avoid battle (Sabin, 2007:403). Greco-Roman battles often showed relatively light casualties compared with the mutual bloodbaths of gunpowder era battles (Sabin, 2007:413). 'Repeated charges', as in the case of the Punic/Roman Zama are explicable if the engagement is not particularly intense and bloody, but this may draw out the war. It masks minimally intensive infantry contests (Sabin, 2007:428). Since combat wounds never have been observed in the Samad LIA skeletal material, conflicts may have been resolved without arms - or else the fallen were buried together in a special place. Frequently, as happened later, LIA warriors probably attempted to organise ambushes either by taking advantage of a mountain pass or by trying during battle to lure the enemy into places difficult to defend.

To judge from the fortification of LIA villages, settlers must have been constantly threatened by marauding Bedouin, Artefacts from the EIA metal-working site of 'Uqdat al-Bakrah are perhaps an example of a Bedouin raiding base hidden in the dunes on the edge of the Empty Quarter, arguably consist largely of grave booty plundered from EIA tombs in and around 'Ibrī (Yule, Gernez 2018:140). Mobile scavengers conceivably recycled the goods at a distance safely away (70 km) from the victimised families from the 'Ibrī area, who would have sought revenge for the grave-robbing.

Battles were lost because their fall had been taken as a sign of defeat (Cahen, 1986:182). The troops must be able to see their leaders. Flags (liwā') or standards must have been necessary for at least a rudimentary organisational point, although not uncovered in excavations in south-eastern Arabia. Possible examples are depicted in contemporary Ḥimyarite reliefs (Yule, Robin 2005-6:363 Figs. 167 & 168).

It is favourable to campaign during the date harvest season in July-August so as to have food for the troops. Once the battle was won, the warriors could pillage the enemy camp. Male and female prisoners became slaves or could be sold. The modest defences suggest small parties of raiders.

As noted above, militias must have been small, and in LIA south-eastern Arabia large campaigns and siege operations (ḥisār) would be illusory. In Oman large armies seem to have been fielded at first during the 9th century Abbasid invasion with 25,000 infantrymen and 3,500 armoured cavalry (King, 2001: 86). Evidently, the Abbasids had far greater resources to solve the logistical problems which the small Samad population could not master. They must have had an enormous infrastructure and funds to manoeuvre in the field. Islamic armies of the day usually had three ranks: First the archers and crossbowmen, second the infantry, protected by swords and shields and third the heavy cavalry (Cahen, 1986:182) - far more elaborate than seems possible in LIA central Oman. For the logistical reasons cited above a tribal militia theoretically might be limited to upwards of 40-50 warriors, comparable with those of tribal razzias (sing. ġazwah). Except during certain episodes of the Ḥimyarite period distantly in south-western and central Arabia, we cannot expect a standing army, and the equipment it needed (uniforms, standard arms etc.). There, armies with up to 2,000 infantry and 3,500 mounted camel soldiers are recorded in the 4th century CE (Yule, Robin, 2005-6:267 table).

It is difficult to conceive of a formal military training and drilling for the Samad LIA warrior farmers, the way we know them for Greek city states of the 5th century BCE. Discipline must have been problematic. For LIA Oman one assumes the beginning of archery training at an early age. A few children's graves contained arrow-heads (graves Bu6/2 & S10823). Present-day notions of the age of adulthood have little bearing on those in the LIA. But the villagers lacked the intellectual tools fostered by the training of a military culture, for example like those of Spartan or Roman armies, presumably lacking intensive military training and a military culture. Military tactics can hardly have been as developed as those practiced and carried out by professional Greek and Roman armies. Tribal chiefs were heroic leaders and not battle managers.

A comparison of the military situation between the jāhiliyya tribal fighting and the far-flung Muslim-Arab conquests shows both similarities and differences. The conquests yielded enormous amounts of battlefield booty which provided a

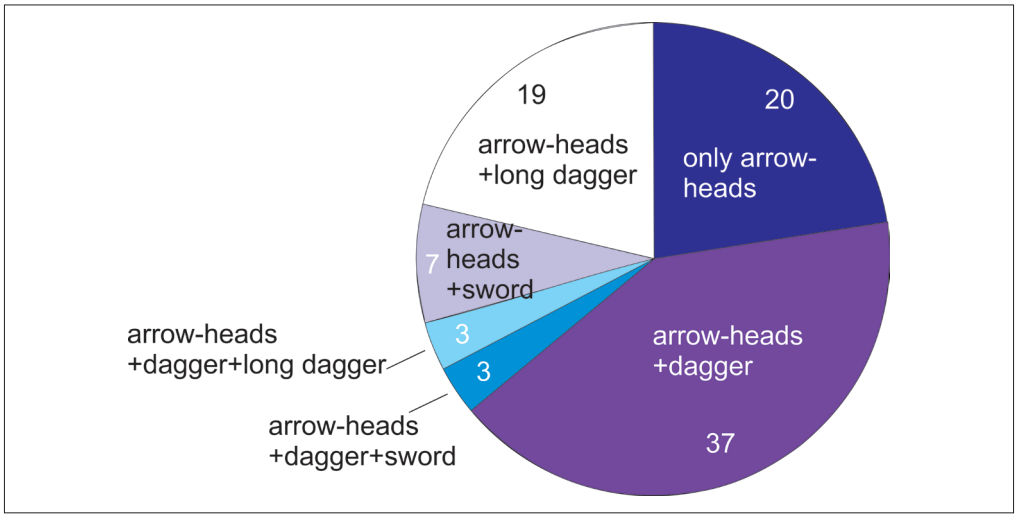

Figure. 4: *Weapon combinations of the Samad LIA graves based on the few intact ones.*

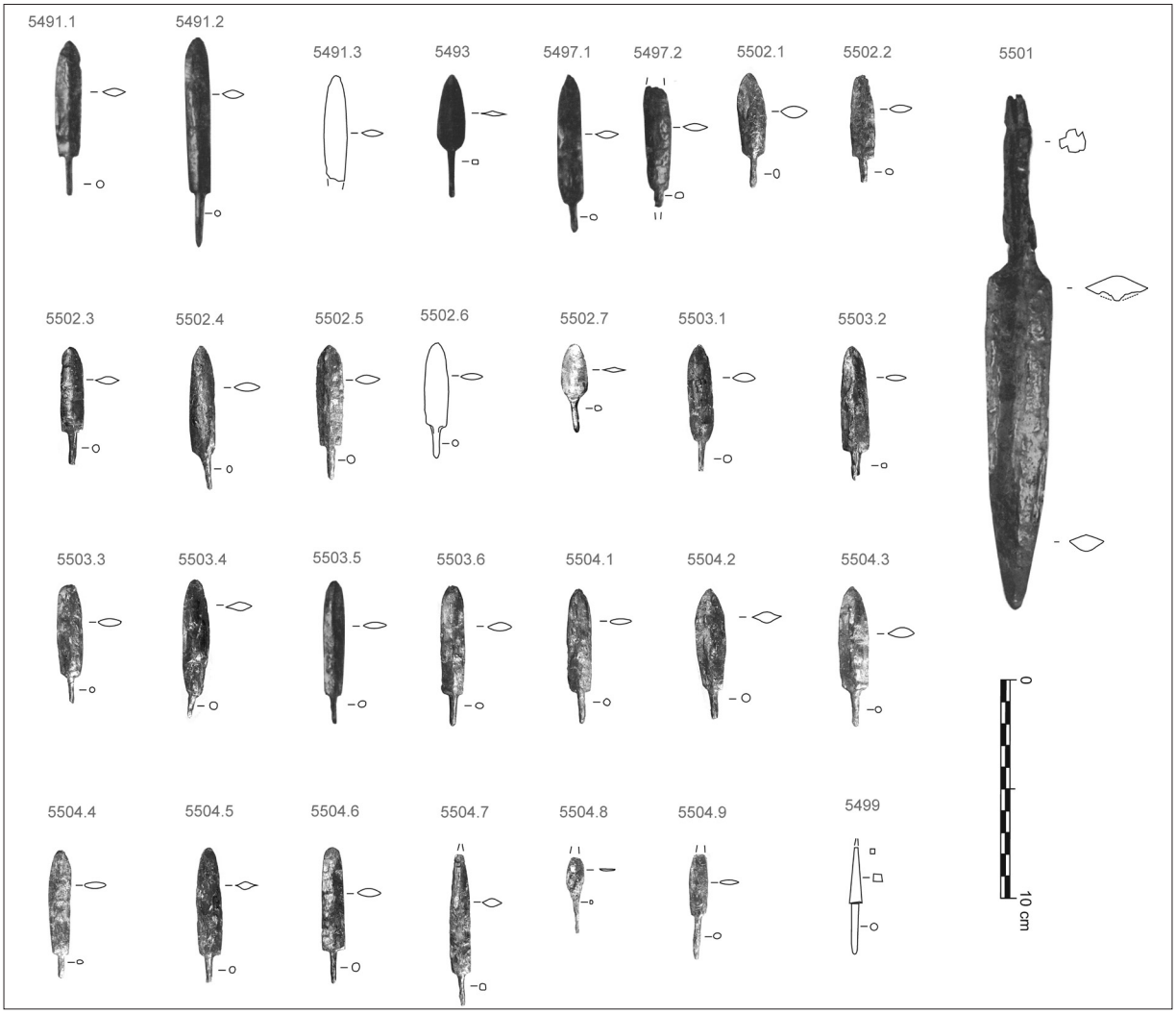

Figure. 5: *Iron weapons from the Samad LIA grave al-Moyassar M2720/2 originally included include a dagger, arrows, a quiver and perhaps a bow.*

motivation to participate. But surely there must be other connections between the two owing to having common technical goals. A main result of the Arab conquests is the importation of Persian and Asian influence into Arabia.

THE WARRIOR'S EQUIPMENT

Prior to the excavation of LIA graves, Old South Arabian and Islamic literary sources provided unrepresentative sources with regard to the individual weapons used. Rock art shows numerous non-specific simple images of weapons usually for hunting which cannot be dated. Iron arrow-heads came to light in the graves with traces of quivers. Archery has earned a place in the Parthian, Sasanian and Arab archaeology and history (Parthian: Plutarch, Life of Crassus. Sasanian: esp. al-Ṭabarī pt. 2 chap. 40, 44. Muslim: Schwarzlose, 1886:38, 246-318.). Ṣayhadic texts (Yule, Robin, 2005-6) from south-western Arabia contain some mentions of swords and lances, but rarely about archery. The Samad LIA weapons combinations are heterogeneous (Fig. 4) since there was no-one to unify them and because the weapons were made or repaired by itinerant craftsmen who served since there were few merchant or trade fairs. Moreover, this also resulted automatically if every militia member supplied his own equipment. To judge from some 87 excavated Samad LIA graves, the typical equipment for an average adult male includes archery equipment (Fig. 5) and a dagger (Fig. 6). The blade weapons are simple and not the product of a development in fighting strategy, like the gladius was.

Only 33 excavated Samad LIA graves show little disturbance and give a good idea of the weaponry2. The only unusual weapons they yielded are two axes and a lance. Bows were probably too valuable to place in a grave. Bone laths from composite bows have rarely survived in Arabia as they do in Roman Europe (exception: ed-Dur gr. G3831, De Waele, 2005:158 fig. 6). Perhaps the main single question is why Roman saggitarii do not need bow cases to protect precious laminated bows, but others do? e.g. the Achaemenids and Scythians. Paradoxically, none of the Samad LIA graves contained the identifiable remains of armour, bow, bow-case, helmet, mace, sling or a shield-all of which no doubt once existed.

Alongside iron armour, Arabic texts mention leather armour (Schwarzlose, 1886:325). Armour consisted presumably of perishable materials such as reed, wicker, leather or as in the 19th century rhinoceros skin. By boiling leather, a cheap armour or scabbards can be formed (Foulkes, 2008:97), but only to a certain degree. This cuir bouilli armour is rawhide which is boiled to make it harder. Josephus records that the Jewish defenders in the Siege of Jerusalem in 70 CE were reduced to eat their shields and other leather kit. The Spanish expedition of Tristan de Luna in 1559 shared this same fate (Cheshire, 2014:47). Analogously, Islamic armour sometimes consisted of hardened leather or felt (Nicolle, 2004:737).

A warrior of higher than average social rank (Fig. 6 above) had in addition a short sword, dagger and a knife, e.g. the intact gr. Am5. This burial was unusual because it contained no pottery vessels, but nonetheless was intact. In contrast to an average warrior, what was the equipment of a tribal chief? Burials S10672, S2020 and S3004 are identifiable owing to their rank-indicating finds and burial status classes (Yule, 2018b). Based on burial S10672, in Fig. 6 below we can see a recurved bow, arrow quiver, arrows, short sword, battle axe and what belonged to horse tack, probably a saddle. Battles axes and horse tack are rare in these graves. The bow is recurved by virtue of EIA miniature ones excavated at Muḍmar (Gernez, Giraud,

2 Graves Am1m, Am2inf, Am3f, Am5m, Bu4m, Bu5f, Bu6m, Bu8inf, S104m, S1018f, S1037f, S10803m, S10825f, S10833inf, S10838m, S101105m, S101116f, S101125m, S101130f, S2101juv.?, S2104m, S2136Njuv.?, S2140m, S2161Ninf, S2172ff, S2185m, S2199m, S21104f (camel), S21115c, S2305c, S2606f, S2613m, S2614juv.?

Key: m= biologically mature male, f= biologically mature female, ?=sex not biologically determinable, inf=biologically child.

I exclude 'Amlā'/al-Fuwaydah cemetery from this discussion, which provisionally I assign to the PIR and not the Samad LIA.

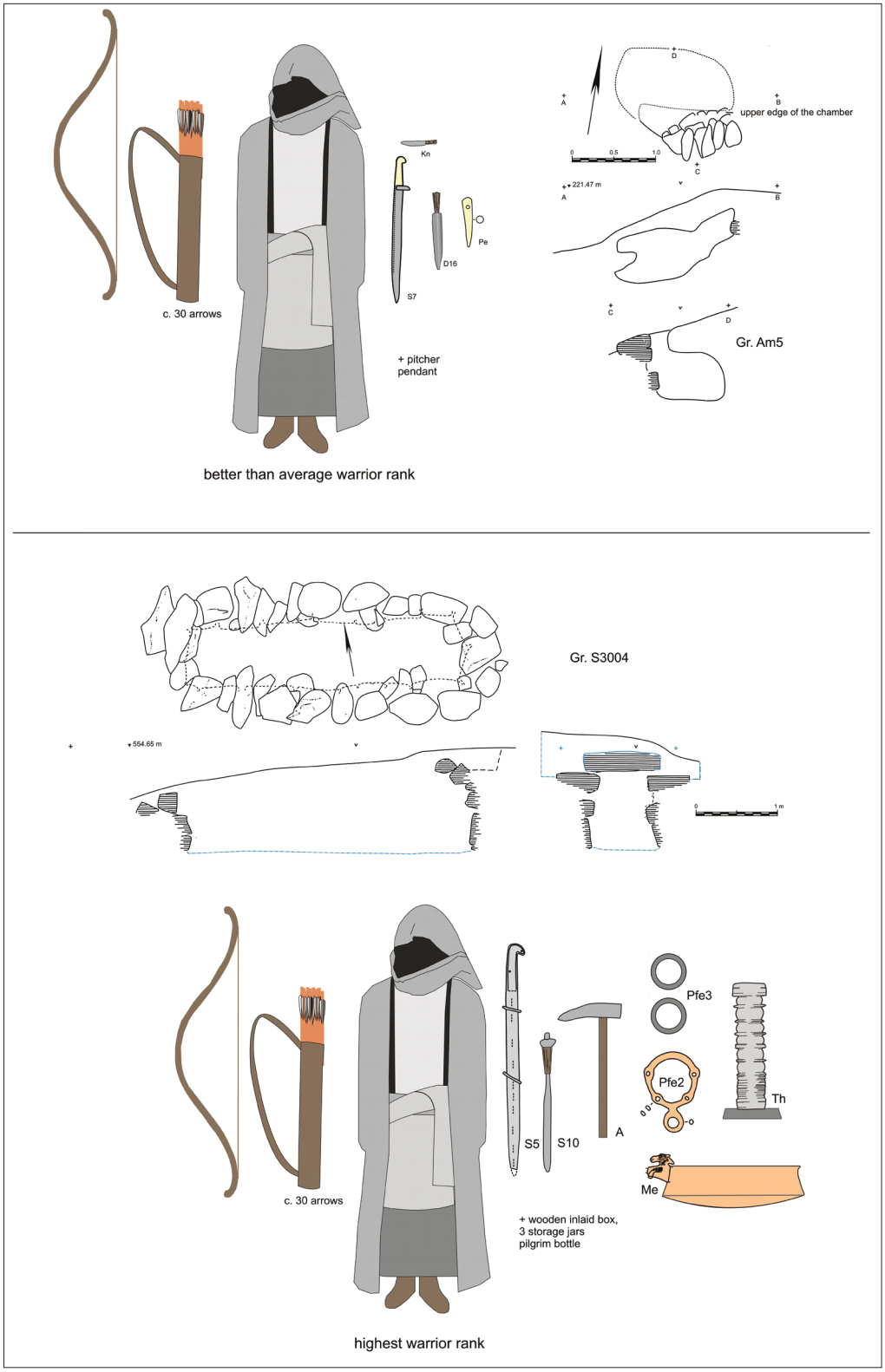

Figure. 6: *Above, grave and weaponry of a higher than average status warrior based on the intact grave, al-'Amqāt Am5. Below, grave and weaponry of a tribal individual of the highest rank. This grave equipment is based largely on the robbed gr. S10672.*

2017:94 fig. 7.11) and Achaemenid Persian ones of a few centuries before. Originally, presumably the entire saddle was placed in the grave. At Samad/al-Moyassar there are qualitatively no better grave goods than these - signs of the highest social rank within the tribe.

Only two of the c. 200 excavated Samad LIA graves yielded evidence for horse-back riding. Gr. S2020 contained a horse bit for a horse with a small mouth (Fig. 7.1). There is no evidence for LIA cavalry in central Oman. To date, only three contemporary depictions of domesticated horses have survived (Figs. 7.4-6). In Fig. 7.5 the depicted horseman rides without the aid of stirrups. It is unclear whether or not his head gear is soft armour. His upper body is naked and he appears about to cast a spear. Lances, which are often associated with cavalry attacks (Douillet, 1991:954), are quite rare in the Samad LIA graves (gr. S3032).

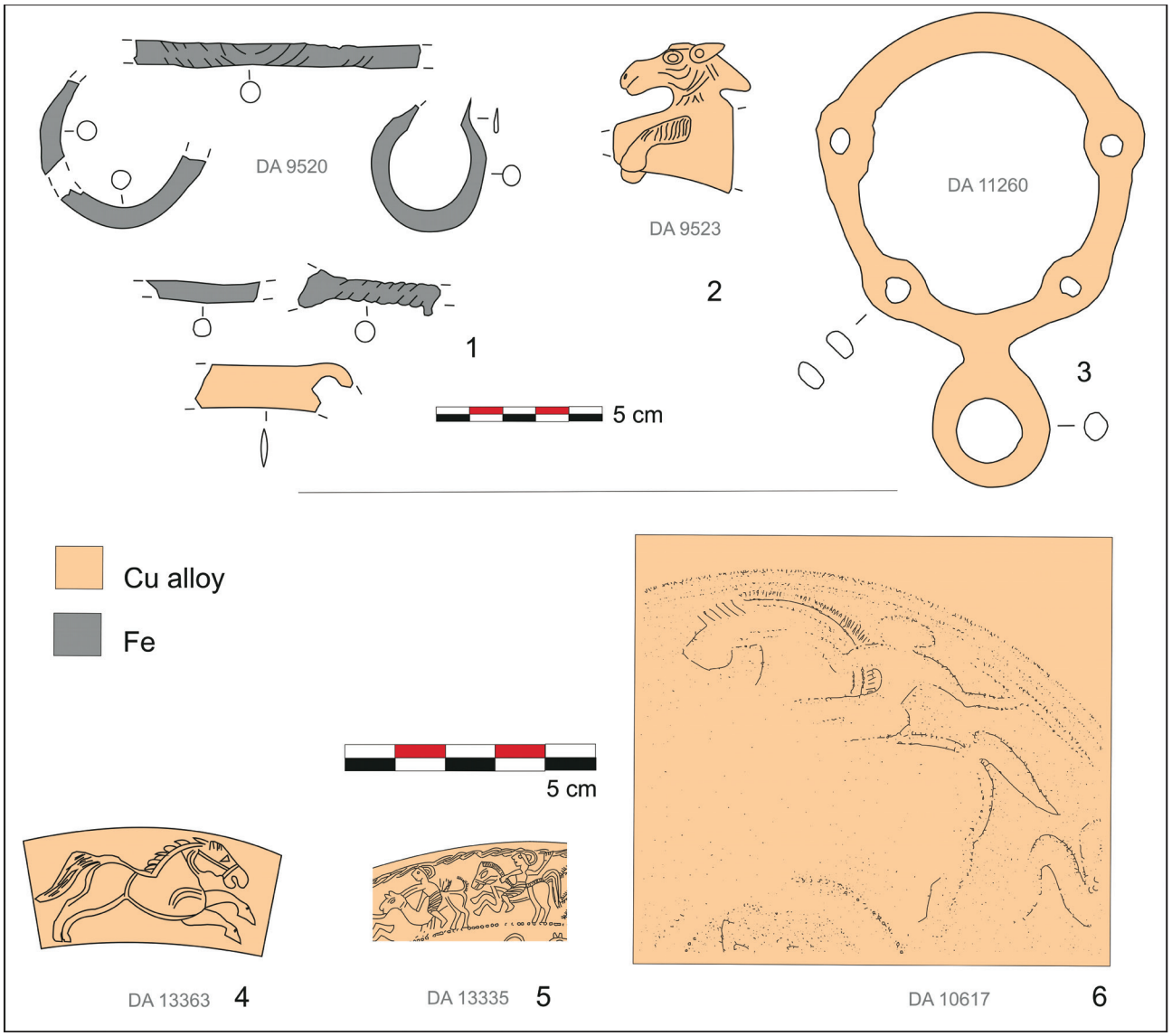

Figure. 7: *Evidence for LIA horse-back riding. 1 consists of fragments of a horse bit. 2 is the spout of a drinking vessel in the shape of the foreparts of a horse. 3 shows part of a saddle ring presumably for the suspension of decoration. Depictions of a mounted riders: (4), a bridled lunging horse (5) and a spear throwing rider are assigned to the contemporary PIR. They appear here for illustrative purposes.*

The horse which appears on another phiale is bridled. The plight of horse seems almost rosy compared with the situation of the 19th century: 'Spikes and caltrops were thrown under their hoofs, pikes slit their bellies, hidden pits opened beneath them. They felt the unsteadiness of a body under their hoofs, and met arrows, spears, lances, pikes, maces, swords, bayonets, bullets, shells and rockets' (Forrest, 2016:319). Nothing like the worst anti-horse weapons (e.g. medieval spiked halberds) are found in LIA contexts. In terms of actual tactics, light cavalry camel soldiers rode to the scene of battle, dismounted and fought with slashing and thrusting weapons. Horses were treasured for sports and for war. While the Arabs have an enormous interest in horses and horse breeding which goes back into the pre-Islamic period, the literature on equitation appears relatively late (Douillet, 1991:953). The origins of the famous five original pure horse strains are a mixture of religion and myth. Serious research suggests a recent origin for the Arabian breed of horses (Viré, 1991:786). Lances, which are often associated with cavalry attacks (Douillet, 1991:954), are quite rare in the Samad LIA graves (only gr. S3032). A male skeleton (S2127/1) at Samad is bow-legged, but in itself this does not present evidence for horse-riding (horses in ancient Arabia: Robin, Antonini, 2017).

Slings are known from the entire Near East from 6500-3000 BCE (Korfmann, 1972:foldout). Xenophon writes that during the battle of Cunaxa (401 BCE), 'with their slings the Rhodians had a greater range than most of the Persian bowmen' (Anabasis III 4, 16). On the other hand, Cretan archers also had greater range than their Persian adversaries (Korfmann, 1972:17 note 2). If the sling has a greater range than a bow, then it must have been a common weapon (Roman peltasts: Griffiths, 1985). Why then is there no evidence for it in the Samad LIA graves? Missing in the graves are diagnostic almond-shaped sling-stones. Evidence for slingers (peltasts, German Plänkler), important in Greek and Roman warfare, is lacking in south-eastern Arabia or is archaeologically invisible.

In south-eastern Arabia also lacking are the weights and hooks of the atlatl or spear-thrower, which existed elsewhere in the ancient world (so Webb, 1957:44-5 figs. 11 & 12). Nor do such spear throwers play a role analogously in the large and important Byzantine army (Kolias, 1968). Most of the relevant excavated points can be plausibly explained not as those of the spear thrower, but rather as arrows and spear/lances.

Presumably the Samad LIA weapons correspond to those of the militias' opponents, unless one were to assume that the opponents prevailed as a result of having better equipment and training, for example Roman or Sasanian ones are better. For this reason, other matters equal, Samad period warriors would have been unfairly matched to face off with an equal number of such warriors. Experts agree from late Parthian times on a 'Persianisation' of the military and dress customs, especially as witnessed at Palmyra and the provincial Dura Europos and Ḥatra (e.g. Goldman, 1994:165, 168 fig. 10.1-2; Yule, 2013a:17-8). But this influence is difficult to define in Arabia and to distinguish from actual presence. The Samad weapons do not correspond to the heavy weapons and armour of those of the Sasanians known in the royal reliefs at Naqš-i Rustam/Fars. In central Oman the LIA iron arms perhaps turned the tide against the defending EIA population with their copper-alloy arms. Although more of the EIA weapons have survived than for the LIA, rarely did they occur in situ which prevents a real understanding of their use.

If we raise the question, do the LIA iron weapons show use-wear, such as traces of fighting, the answer is no. 2000 years of burial, robbery and weathering has taken its toll even in intact graves. Some of the copper-alloy arrowheads show blunted tips, but these belong to earlier periods.

In the graves of the Samad period piercing and slashing weapons may occur paired together with the durable remains of their arrow-heads. Arrows belong to old Arab attack and defence weapons (Schwarzlose, 1886:38) and served for attacks at a distance, suitable to defence against Bedouin razzias. Arabic texts relate much about their use in war and hunting (ibid. 40). The irregularities of the different excavated weapons do not awaken the impression of the equipment of a normed equipment of regular

soldiers, but rather that of an irregular tribal militia with different equipment sources.

Although Samad LIA graves yielded lances/spears, the vast majority date to the Bronze Age Wadi Suq period and are bronze. Javelins and spears are also common in the entire Near East (cf. de Maigret, 1976:169) with regard to the Muslim period use of the lance in Mesopotamia. Only wealthy Arabs were mounted and fought with the lance. It was primarily a thrusting weapon (Schwarzlose, 1886:45-46).

ARCHERY

Outside comparisons contextualise LIA archery. Departing from the meagreness of mentions in Ṣayhadic texts, A. Beeston believed that dagger and lance were the main weapons for the rank and file in Old South Arabia and that archery was mainly used for the hunt (1976, 13). Years afterward, C. Robin found himself in the same situation in a study of Old South Arabian knights and hunters (Yule, Robin, 2005-6; in general on hunting in pre-Islamic Arabia: Maraqten, 2015). Potts is more careful and points out that Beeston may press his point too far, citing rock art in Arabia which shows archers (Potts, 1998:200). Little evidence in south-western and central Arabia has come to light yet in excavations. However, there, the most numerous weapons contained in the Samad period graves remain arrow-heads. The publication of the arrow-heads excavated from the Middle Assyrian to Parthian/Roman Periods from Tall Shaikh Ḥamad in Syria provide a diachronically sorted comparative source material not available till recently (Hellmuth Kramberger, 2016).

What shooting tactic did the archers use? The firing of massive barrages of arrows is well documented in antique warfare. The most dramatic descriptions pertain to the battle of Carrhae in 53 BCE in which the Parthian archers decimated the c. 40,000-man Roman force, perhaps the most crushing defeats in Roman history. Pinned down, the Romans hoped that when the Parthians ran out of arrows, they could engage them. But they soon noticed that the Parthians had entire camel caravans loaded with countless arrows (Plutarch, Life of Crassus, 25). If the archer struck an armoured opponent, the resulting injury could be minor. This could be enhanced by shooting as many projectiles as possible. This barrage strategy was perfected perhaps during the 12th and 13th centuries in the French - English wars. If from 3-12 arrows were fired pro minute, a force of 10,000 could fire from 150,000 to 600,000 arrows in a five-minute barrage (Eckhardt, 1996:129 tab. 7). If this barrage strategy was common, why then in Arabia are so few arrowheads preserved?

Obviously after a given melée, colleagues quickly removed their deceased comrades' weapons (e.g. Homer, Iliad, 4th song, 465-471). The equipment were highly valuable and were not to fall into enemy hands. With few exceptions, for ancient authors arrowheads are a minor detail unworthy of mention. For reason of his detailed battle descriptions, Homer forms an exception (e.g. Iliad, 3rd song, 330-340) especially his description of armour. At Masada, Yadin found hundreds of arrows in heaps which were to have been set on fire (1966:96), but rarely with the typical trilobate Roman iron arrowheads. The Romans would have removed any metal for re-use, repair or re-cycling (Coulston, 1985:267, fig. 46).

Anciently archery was a socially ambivalent profession: Either the archers belong to the lowest ranks, or kings prided themselves on their archery prowess. Darius I proudly has inscriptions made which praise his archery skills on horseback and on foot (Zutterman, 2003:142). Much earlier the same holds for the Egyptian pharaoh Amenhotep II - always ready to demonstrate his athletic invincibility (Wilson, 1951:198). Neoassyrian kings and north-western Iranian rulers are depicted as archers (Zutterman, 2003:143). Among the Roman sagettarii belonged on the whole to specialized archer auxilia regiments. The 6th century Byzantine general Procopius speaks derogatorily of the archers before his day, without a horse and armed with only a bow and arrows. Obviously these were the poor, in his day who socially and militarily were upgraded to fully armoured mounted archers (Procopius, Persian War, I,1, 9-10). Until recently archery - this most

basic defence - has remained invisible in ancient accounts, with notable exceptions in Europe (Yule, Robin, 2005-6:265-266; Eckhardt, 1996:112-132).

Without considering both the history and archaeology archery, the study of arrowheads in isolation is a sterile antiquarian occupation, an island solution. Basic ballistic questions include how arrowheads harmonise with the other key components - the bow and arrow-shaft. Based on chance finds and mixed contexts and a few lucky finds, if our excavated sample from south-eastern Arabia were representative, it would not change so often. Relying solely on this information will yield a flat representation of actual affairs.

QUIVERS

The arrows in their quivers were placed into the graves, but the organic parts have not survived. At least traces of leather are preserved, in addition to the cramps which belonged to quivers (leather traces on arrow-heads: gr. S10805, S10806, S10832, S2104, S2113/4, S2199).

Both Sumerian (a-ma-ru) and Akkadian (išpatu) texts mention quivers which establish their antiquity as early as the 2nd and 1st millennia in Mesopotamia (for the bibliography see Seidl, Stol, 2015:616). Perforated metallic floors for cylindrical quivers are well-known in the EIA (Lombard, 1985:fig. 106), but not in the LIA. Linen quivers came to light in the tomb of Tut'ankhamūn (McLeod, 1982:62). In Arabic texts arrows occur mostly in leather quivers (Schwarzlose, 1886:290).

The arrow-heads from quiver finds are identical with those from disturbed grave finds, especially from Samad LIA graves. In intact graves such as S2199 bundles of points corroded together were deposited in leather quivers. Probably most or all arrow-heads excavated from graves were placed there in quivers. While 26 quiver finds are documented for the Samad LIA (Fig. 9), prior to this in central Oman they are rare (cf. in the UAE Weeks et al, 2018:12 fig. 9; Yule, 2018a:52 Fig. 4.10). What survives in the graves are quivered arrow-heads corroded together with the points at about the same level. Normally in such burials the arrow-heads point downward toward the deceased's feet (Table 2). In the quiver, the arrow-heads point downward so as to protect the fletching. Although presumably the quivers were worn on the back, in the graves the quivers lay both in front and behind the body.

Table. 2: *Some 26 groups of arrow-heads from LIA graves can be designated as quiver finds. They contain each some 27-30 arrows. Senior warriors also have a full supply, like mature ones.*

Burial No.	Anthrop. Age	# Of Points
S10838	70-80	3
S10839	70-80	32
S2137/1	60-80	35
S2140	60-70	20
Am1	60-70	4
S10813	50-60	45
S104	50	26
S2138/3	40-50	32
S2104	30-50	37
S2613	30-50	27
S10806	30-40	24
Am5	30-40	23
S2185	25-35	10
S2615	20-60	27
S10817	20-40	29
S10812	20-40	26
M2720/2	20-40	23
S2135/2	20-40	18
S10805	20-30	37
S2199	20-30	35
S2137/2	20-25	32
S10823	13-14	15
S3009	-	34
S3020	-	29
S3023	-	11
S2110	-	39

Sometimes only a few arrow-heads occur in an obviously robbed grave instead of the expected full quiver. Some quiver finds are identified by means of the number of arrow-heads, others by bundles

of arrow-heads in the graves corroded together. The number of arrow-heads in a quiver provides information about the use. Full quivers (25-30 arrows) in pharaonic Egypt (Yadin, 1963:82) or in 7th century Byzantium (30-40 arrows) (Eckhardt, 1996, 113) suggest actual combat, and numerous such finds from Samad LIA graves. A Nuzi text records, '5 leather quivers, 30 arrows in each' (Yadin, 1963:82). Sasanian quivers might contain 30 arrow-heads. Small numbers of arrows in a quiver suggests rather hunting (pers. comm. M. Korfmann).

Rarely, arrow-heads show a texture from leather quivers mineralised into the metal (Figs. 9a, b). Points from quiver finds are confirmed as arrow-heads and cannot be understand out of context as spear or javelin points.

With some 130 excavated examples (Fig. 10), cramps are a characteristic artefact of the Samad LIA. While they occur in the graves, unfortunately, rarely are they in situ. One assumes a main use was to hold leather quivers together. Gr. S2185 contained a cramp found together with a dagger. Otherwise they rarely have been reported in south-eastern Arabia (e.g. Potts, 1998, 201 fig. 15). Normally three or four may occur in a given grave. Rarely they contain traces of wooden objects (e.g. graves S101128 & S2172-). Occasionally cramps also may occur in women's graves, naturally without weapons.

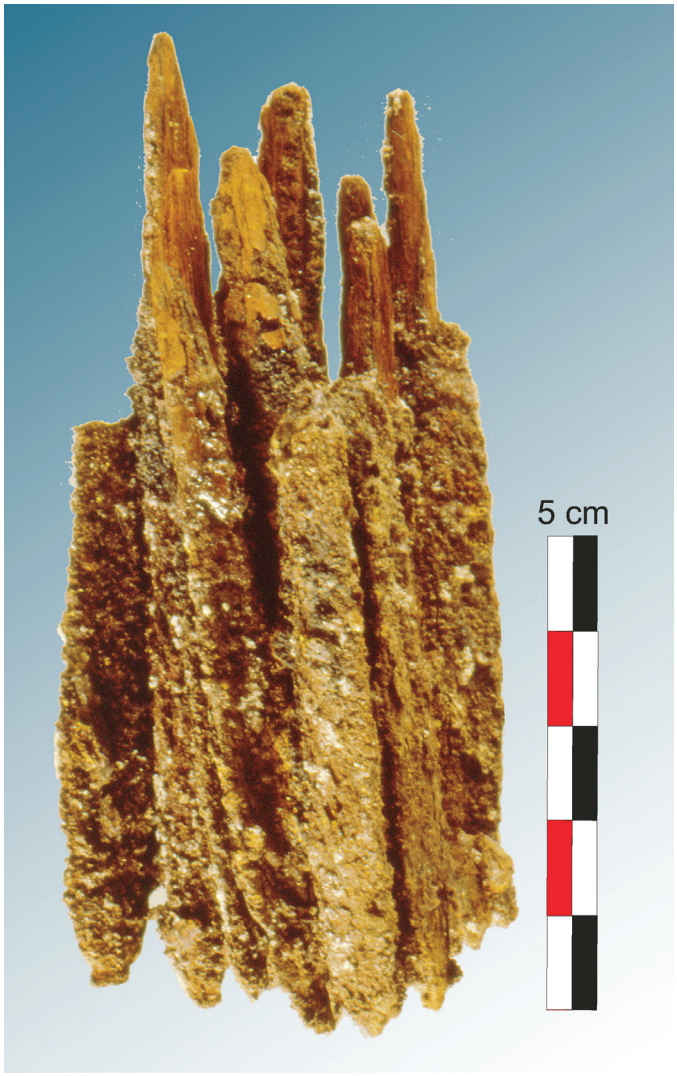

Figure. 8: *Quiver find of 18 iron arrow-heads corroded together from Samad gr. S2137/2 (DA 9622). Originally the arrows pointed down in the quiver.*

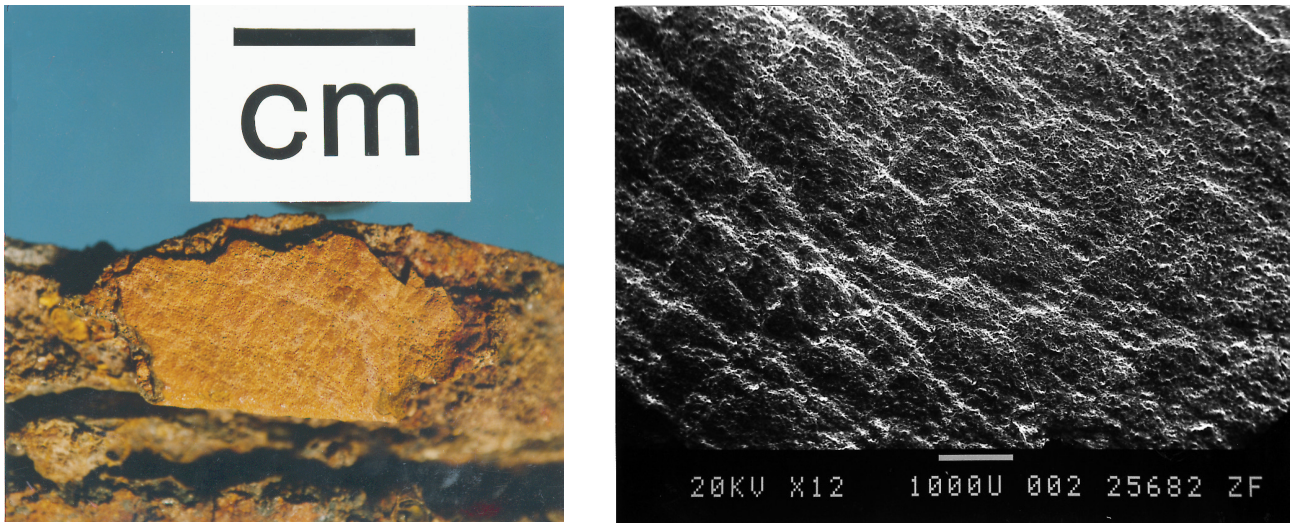

Figure. *9a, b: The arrow-head DA 9388 from Samad gr. S2104 shows leather structure recorded perfectly in iron oxide. b. Scanning electron microscope micrograph of the leather structure.*

BOWS

Woefully incomplete in Arabia, much information regarding ancient bows derives from outside sources. Neither bows nor parts thereof have survived in LIA south-eastern Arabian graves. Tell-tale bow-laths with their string notches, made of flexible materials such as bone and sinew have not survived, except in one burial at ed-Dur (De Waele, 2005). Most information derives from depictions and comparisons from other parts of the ancient Near East, from earlier periods. The closest, of the Ḥimyarite period in SW Arabia, has yielded depictions of archers with a double convex, composite bow (Yule, Robin, 2005-6:362 Figs. 165 & 166), but few arrow-heads or other related artefacts from here are extant. Four kinds of bows are in evidence in the ancient Near East: the single convex arc, 'self bow' or 'simple bow', a simple wooden stave (Fig. 11a). The double concave shape is a re-curved at the ends (Fig. 11b). This is expected in the Samad LIA. The B-shaped, double convex bow is a re-curved bow sometimes described in profile as a Cupid upper lip shape (Fig. 11c). Finally, the 'triangular' bow bends at the grip forming a 120° angle (Fig. 11d). In the 2nd millennium the double concave and double convex bows supplanted the older simple bows (McLeod, 1970:35). Especially double concave and double convex bows are made from laminated wood. Horn, sinew, glue and are termed 'composite bows'. However, a few ancient such ones are non-composite (Yadin, 1963:62; Zutterman, 2003:122).

The double convex bow appears in surprisingly early representations from the Uruk period in Mesopotamia and predynastic Egypt (Korfmann, 1972:212). In the second half of the 4th millennium recurved, laminated, composite bows are widespread in Mesopotamia and Iran (Zutterman, 2003:123). For example, the famed 'Uruk Stele' of that same period shows a composite bow (Korfmann, 1972:pl. VIII.1) as do predynastic Egyptian palettes (ibid, Taf. X) and in dynasty I and II (Rausing, 1967:70-72). To judge mostly from ancient depictions, it was not until Sargon I and afterward in the Akkadian period that the re-curved composite bow came into common use (Zutterman, 2003:123 note 128 for bibliography).

Perhaps the single most important find in the discussion of early Near Eastern archery are the finds from the tomb of Tut'ankhamūn of the mid-2nd millennium BCE. They may be far away spatially and temporally from EIA south-eastern Arabia, but the phenomenal preservation with a large body of archery equipment is important for us because they are dated. This shows the high degree of archery development already at that time. This

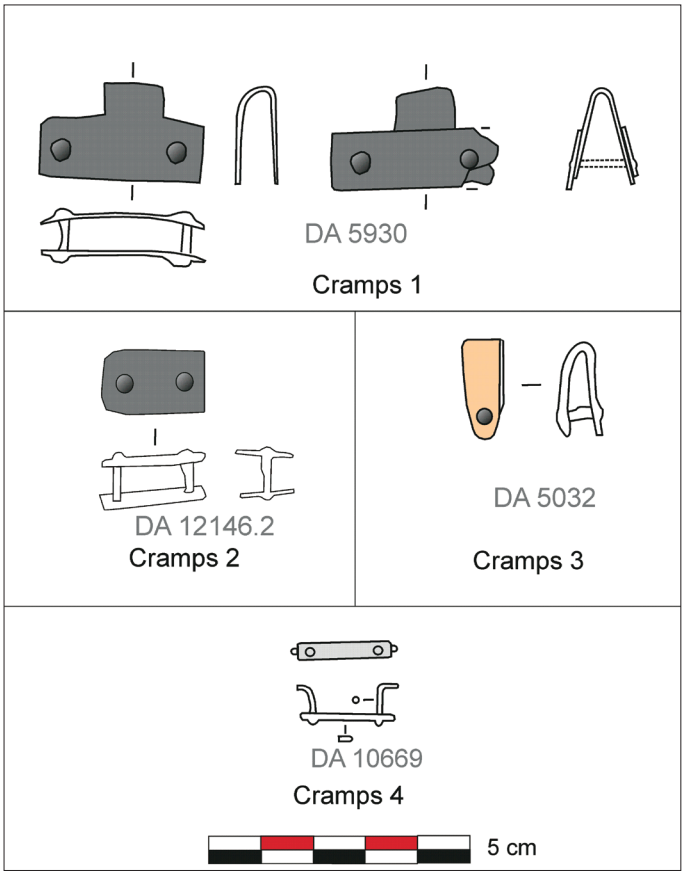

Figure 10. *Some 130 cramps came to light in the graves, mostly in context with arrow-heads. Thus, they usually seem to have been used to hold quivers together. Most consist of iron (cramps 1 & 2), but also copper-alloy (cramps 3) and silver (cramps 4) occur.*

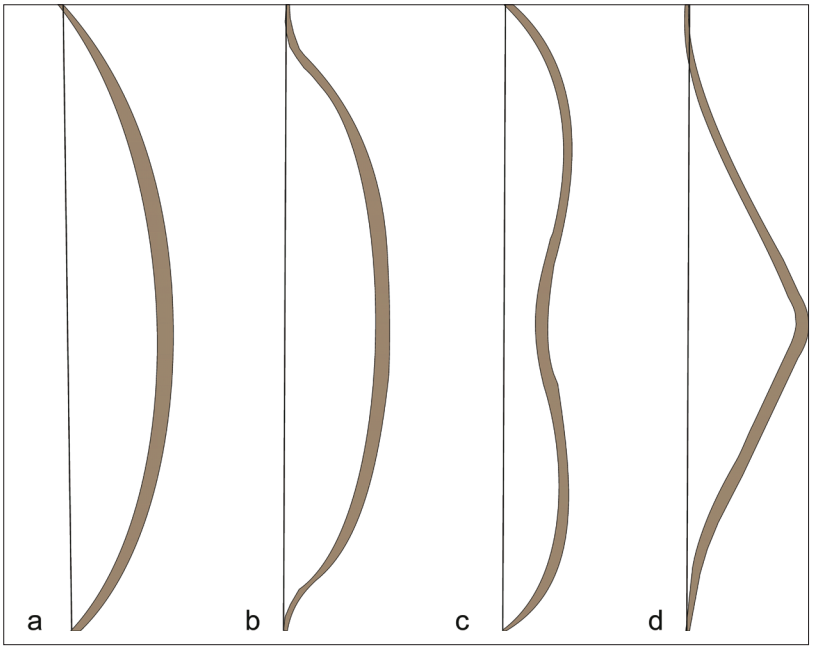

Figure 11. *Four main types of bows include a single arc (self bow), b re-curved, c B-shaped, d triangular (Zutterman, 2003:158 fig. 2), not to scale.*

tomb contained in all 32 composite bows, 14 simple bows and 395 arrows and 27 arrow-heads (McLeod, 1982:13-26). Several ancient Egyptian composite bows are preserved, which belonged to the pharaoh. These were fashioned from acacia, carob, lemon and sidder wood (McLeod, 1982:52). Suffice it to say that these bows originated in Asia before being produced in Egypt (McLeod, 1970:37).

Composite Scythian bows were famous for their strength, their archers for their deadly accuracy. Vast stores of arrows came to light in the graves of both males and females (Mayor, 2014:210-17). The Romans also produced composite bows, manufactured from selected woods, horn, tendon and bone (Junkelmann, 1986:194). Stronger than Roman ones, double convex Parthian bows were fearsome (Plutarch, Crassus, 24). Composite bows appear both in Roman (Trajan's column) and Parthian art (relief depiction of a Parthian cavalry archer, Palazzo Madama, Turin, Wikipedia: Parthian horseman), not to mention the famous composite bow found at Yrzi, near Baghouz on the Euphrates (Brown, 1937; Coulston, 1985:239-40). This example dates from the 1st century BCE to the 3rd century CE. The production of a composite bow may take as long as months, and the archer was extremely careful to protect it from the elements, especially from moisture.

The range of ancient bows has been tested by means of experimentally produced copies, 'The English yew long-bow was effective up to 220 m, and could cast a flight arrow as far as 265 m; but it was the finest simple (self) bow ever devised, and probably far surpassed any wooden bow of the ancients. A series of tests of weapons from anthropological collections suggests that bows like the native Egyptian one, might attain a maximum range of 155-190 m. A good composite bow is more powerful than a good self-bow' (McLeod, 1970:37). To judge from Sumerian, Akkadian and Elamite texts and depictions, (for the bibliography see Seidl, Stol, 2015:618-619) bows were in common use during the entire 2nd millennium. Although special Roman lightweight flight arrows had a maximal range of 500 m, normal ones had an estimated maximal range of 200 m (Junkelmann, 1986:194). This may or may not apply for the compound bows presumably used in LIA south-eastern Arabia.

ARROWS AND ARROW-HEADS

Parameters for arrow-head use such as maximal range can only be inferred by means of their find circumstances and form characteristics. Main sources for archery are ethnographic as well as experimental (ballistics, see Eckhardt, 1996:41-78). Those of the Samad LIA are of iron, tanged and are long and biconvex in section, pointed, but other point types may existed which did not survive, such as of bone. More effective are socketed ones with a mid-rib, especially if the opponent is wearing armour. On impact, arrow-heads are less likely to be forced into the arrow-shaft, and the profiled middle rib saves weight. In finds of great numbers of arrow-heads, we can assume that they are used against humans. Their relatively large size also supports this assumption. Some 900 iron arrow-heads (Fig. 12, Table 3) from excavated Samad LIA graves are nearly as numerous as are beads, the most numerous kind of find of this period. Both prior to and after cleaning, iron arrow-heads artefacts are surprisingly difficult to draw successfully. Despite the corrosion, some reveal excellent workmanship and refinement in the forms. So-called bolts (Fig. 12 Ar15) have been explained to pierce armour, but also to hunt small game. Stump-ended arrow-heads, to break bird wings (for instance McLeod, 1985:pl. v uppermost arrow on page) are not in evidence.

Mineralised wood traces in the iron oxide of tangs show the arrow-shafts to have been of deciduous tree wood (Yule, 2001 I:199 note 1844). The arrows from the tomb of Tut'ankhamūn show a variety of materials and construction methods. Both hard woods and reeds served as shafts. (McLeod, 1982:54) - materials not available in Oman. Presumably Wadi Suq points identified as Ar19.1 arrow-heads from pre-Islamic al-Akhḍar cemetery can range up to 12.8 cm in length and weigh up to 24 g (Yule, Weisgerber, 2015:121-122, Pl. 13.1-6). Since they occurred together with others smaller but similar in shape, at least preliminarily we can

accept them as arrow-heads. But many cases exist of points which differ in shape in different ways. In such cases a question mark is necessary and some may have been small daggers, not arrow-heads.

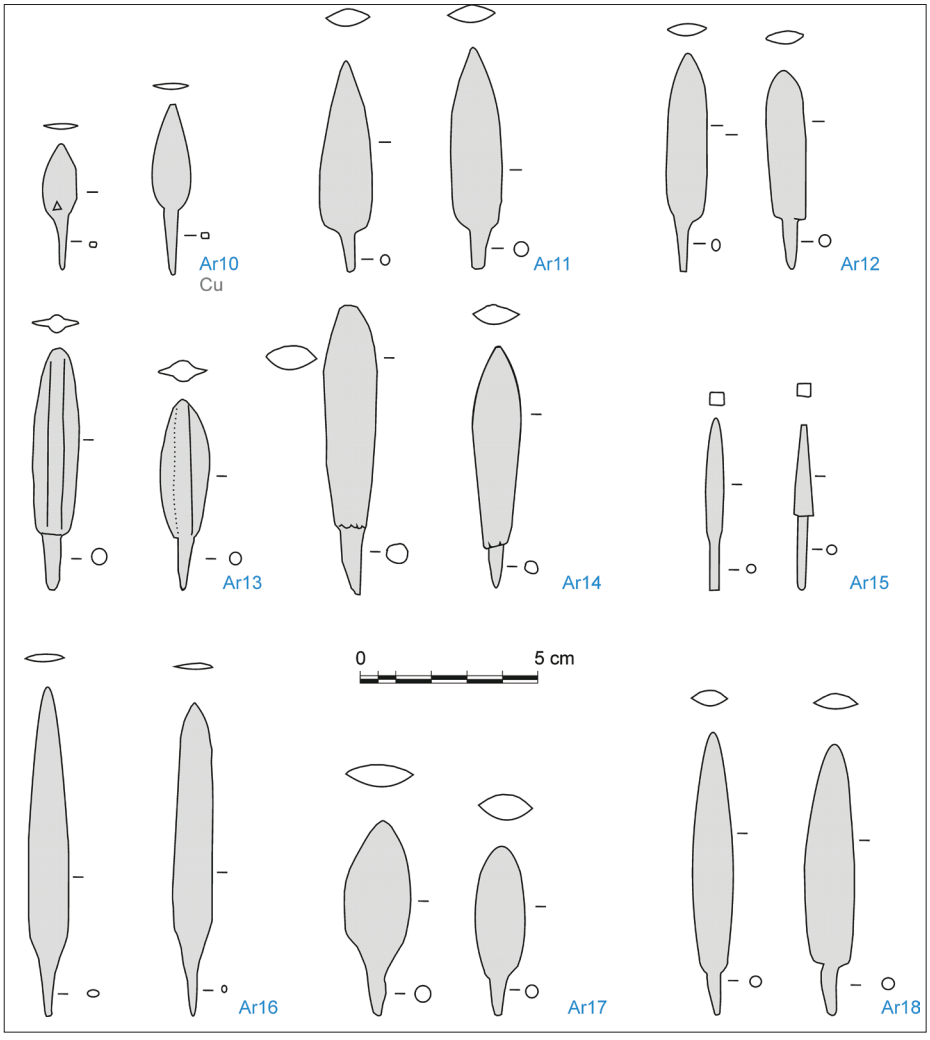

Figure 12. *The vast majority of Samad LIA arrow-heads are made of iron. Rare Ar10, in copper-alloy, usually occur in LIA contexts.*

Table. 3: *Artefactual class definitions of Samad LIA arrow-heads. Nearly all are fashioned of iron.*

Class	Morphological and other attributes
Ar10	Cu, leaf-shaped, long tag, biconvex in section
Ar11	middle length (7.8 cm), margin is wide, thick section, symmetrical in shape, relatively heavy
Ar12	parallel edges, middle length
Ar13	long, thin, edges slightly biconvex, both with and without a midrib
Ar14	middle length, widest toward the point, a few in Cu alloy
Ar15	pointed, quadratic in section, tang circular in section
Ar16	very long and proportionately thin, thin in section, willow leaf-shaped
Ar17	wide, biconvex edges, strongly biconvex in section
Ar18	very long, willow leaf-shaped, some with a slight midrib, thick in section

Unfortunately, although generally various measures of length and width of arrow-heads are recorded, their weight rarely appears in excavation reports. In the typological study of metallic arrow-heads which Cleuziou submitted in 1974, 2500 excavated arrow-heads are included, of which not a single weight was recorded (van Deelen, 1993:1). Lacking this information, Cleuziou had to distinguish arrow-heads from other implements based on the shape and length (see below). Objects that are 'too big' to be arrow-heads are classified as javelin heads or daggers. M. Korfmann and others (see below) attempted a differentiation between arrow-heads and other projectiles such as javelin-heads (1972:28-42, esp. 40).

Thornton and Pigott's maximal size of Iron Age NW Iranian arrow-heads of 8-9 cm (2011:138, 140 pl. 6.3 (quiver find)) is not used here since arrow-heads confirmed in quiver finds from Samad graves are longer (Fig. 10).

In 1972 M. Korfmann cited the anonymous 16th century Arabic-language Book on the excellence of the bow and arrow (=Faris, Elmer, 1945). Discussed here are simple and more effective composite bows. The latter exist already at the end of the 4th mill. BCE, which Korfmann (1972:17) posits to judge from the kinds of defences that the attackers were attempting to conquer. The weight of the arrow-head must harmonise with the pull of the bow and the firmness of the arrow shaft (the 'weight of bows', Faris, Elmer, 1945:166). This 'maximum weight' of the arrow-head is 7 g which were launched by 'primitive' bows. Since such are not defined, it is difficult to construct arguments. This weight is based on the preferred weight for arrows used by the Persian kings, as recorded in a 16th century Arab manuscript (see below). L. van Deelen (1993) argued that this weight more likely applies to composite bows and iron arrow-heads than to prehistoric bows and stone arrow-heads. Moreover, she reasoned that this weight is a 'preferred' one, rather than a maximal one.

Tut'ankhamūn's tanged arrow-heads show a variety of details which one could hardly expect to understand from the examples which derive from south-eastern Arabia. For example there is a variety of point shapes and materials, the latter including bronze, ivory, stone and glass. 120 have sharpened wooden points. These points should really be studied again in detail, to explain their exact purpose. Bronze leaf-shaped arrow-head blades range in length from 10-15 cm in length (McLeod, 1982:20-21, pl. v below). Inserted into the arrow-shafts, the lengths of the tangs are unknown.

How large can arrow-heads be? The larger and heavier the arrow-head, the larger the bow must be to shoot it. While some arrow-heads of the Ar19.1 class may be as long as 12.9 cm, others of the same length, but different in the tang and blade shape may be possibly cutting/sticking weapons. Late Bronze Age bone arrow-heads from the eastern Baltic region have prodigious dimensions. These two-winged projectile points may range up to 16.5 cm with 14.2 g weight (Luik, 2006:137, 135 fig. 2). Special African arrow-heads up to 90 cm in length of the Mandinka and those of other tribes have been published (Wiethase, 2016:13, 20, 34-41 etc.).

LIA points never exceed 12 cm in length and rarely 13 g in weight. The weights of Ar11-Ar15 and Ar17 and Ar18 points (Figs. 13 & 14) range between 11 and 13 g - far heavier than Korfmann calculated for a primitive bow. In the Samad LIA the most desired weight laid between 9 g and 11 g (Fig. 15). The lengths of confirmed examples of iron arrow-heads (Ar13 and Ar14 classes) of the Samad LIA, are heavier and larger than those of the EIA, which precede them. The majority of the arrow-heads range between 7 and 15 g with 10 g as the most common one. Modern tournament arrows weigh around 16-25 g (Eckhardt, 1996:48), lighter than many iron arrow-heads alone from south-eastern Arabia. In the medieval period Persian arrow-heads were thicker than those of the Arabs. Also their bows were heavier, larger and with a greater range than those of the Arabs (Schwarzlose, 1886:251; Bauer, 1992:39-59). In the EIA, to judge from the weight of the arrow-heads, the bows certainly were smaller than those of the LIA and medieval period.

Ar7 and Ar8 points are the heaviest of the copper alloy ones. Re-curved bows (Figs. 11 & 13) were widespread and perhaps closest to south-eastern Arabia (Zutterman, 2003:165 fig. 8). For this reason Samad

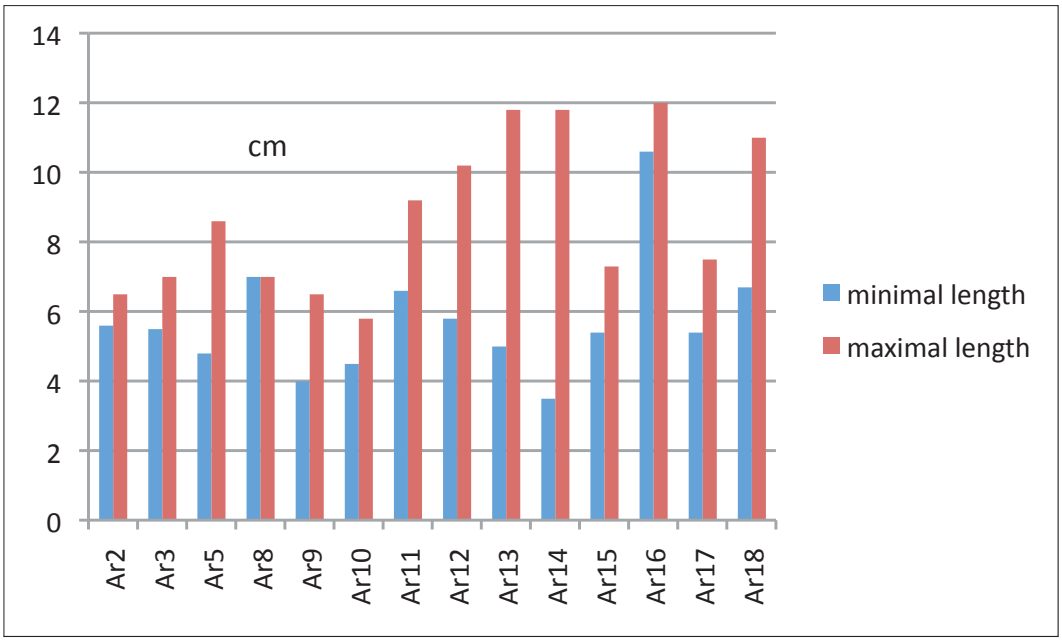

Figure 13. *Minimal (blue) and maximal (red) lengths of arrow-heads from quiver finds from graves mostly in Samad. X=arrow-head classes, Y= g. Ar11 to Ar18 are LIA iron points.*

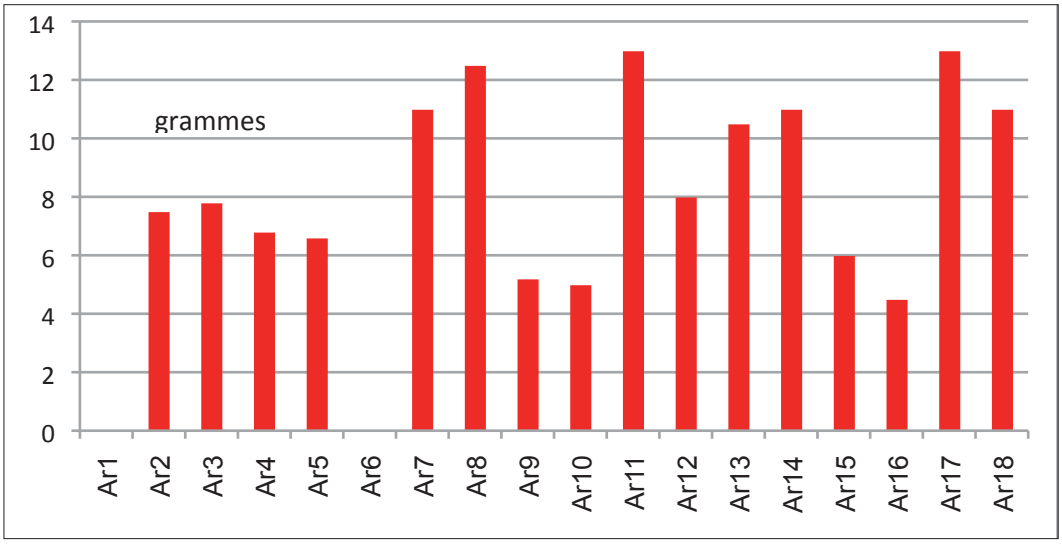

Figure 14. *Average weights of different Cu and Fe arrow-head classes. For the class definitions: Table 3 or Yule 2001 I:108-9.*

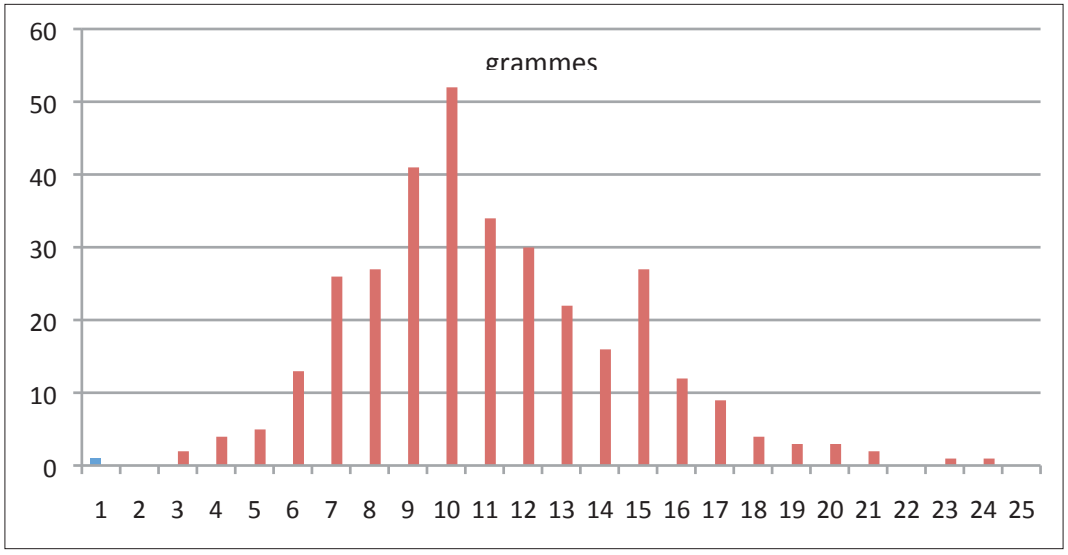

Figure 15. *The weight distribution in grams of Ar13 and Ar14 arrow-heads. The most frequent weight is 10 g.*

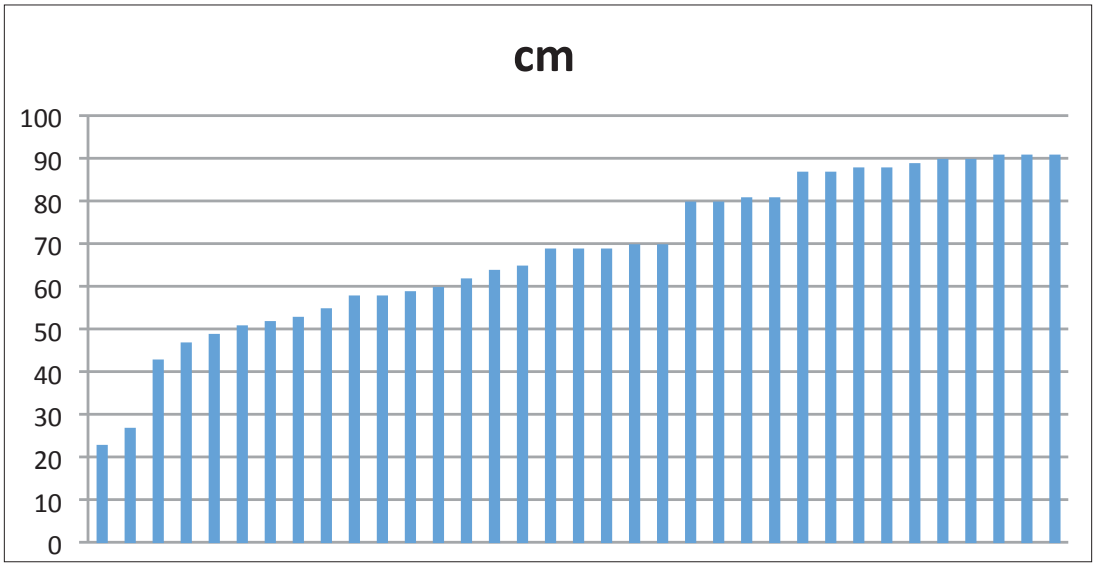

Figure 16. *Lengths of arrows in the tomb of Tut'ankhamūn, averaged by their published find-lots. N. 35. Given their excellent preservation, they given a good idea of the many different kinds of arrows available at the time.*

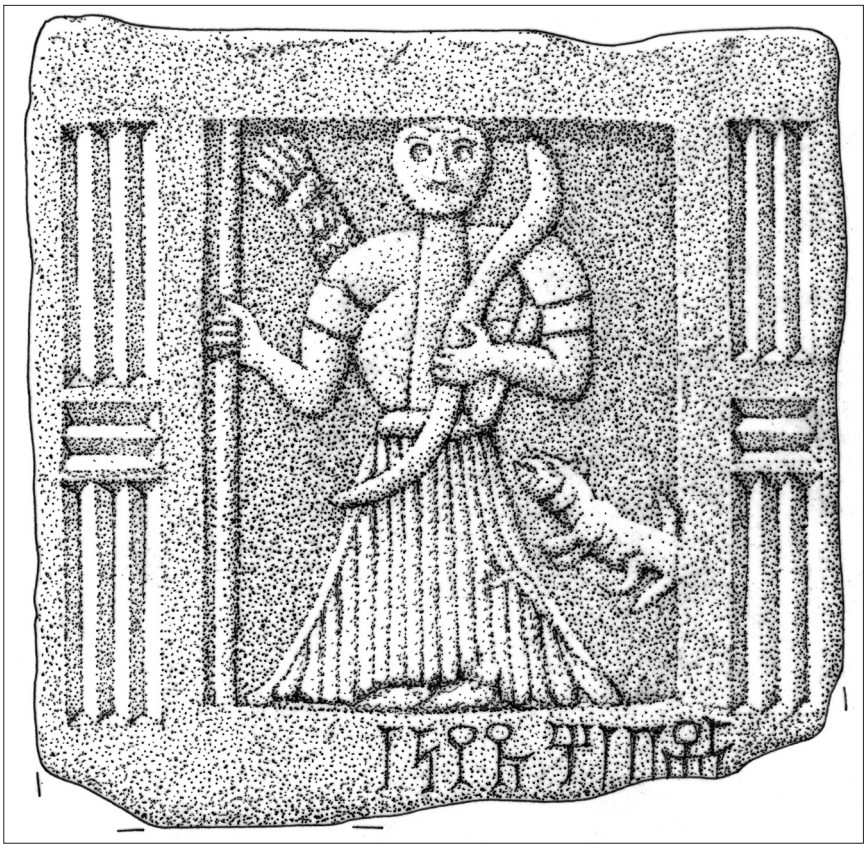

Figure 17. *Ḥimyarite period high-status warrior depicted with his dog. Hunts often took place alongside military operations, stages where upper charges strengthened their social rank.*

archers may have shot with such composite bows as shown in Fig. 6 above & below. Unlike the Bronze Age ones at Tell Shaikh Ḥamad (al-Rawi, 2011:323); there is little evidence for conclude different purposes for different points, aside from Ar15 points.

If in south-eastern Arabia sharpened wooden points were in use, then no trace of this kind of artefact has survived. Fig. 16 shows that the majority of arrows are longer than 50 cm and reach 90 cm. This find gives a reference point for the lengths and weights of the LIA arrows of south-eastern Arabia.

Generally arrows and related projectiles were fletched to give them a spin in flight as we know particularly those from the tomb of Tut'ankhamūn's and from Dura Europos (McLeod, 1982:59-60; Coulston, 1985:fig. 45). The former have three, less often four vanes. The latter have three. Eagles, vultures and falcons supply the best feathers. Unfletched, simple arrows find mention in early Islamic poetry (Schwarzlose, 1886:316-9), which had little range. Rarely are the threads preserved used to fix the arrow-heads to the shafts. The LIA arrow-head is invariably stuck into the shaft, not always the case previously. Still missing are LIA grooved arrow straighteners.

Pre-Islamic images of archery have rarely survived in Arabia. A Ḥimyarite period relief shows a high-ranking warrior with a re-curved bow (Fig. 17). This suggests that different bows were in use contemporary with the Samad period, as speculated in Fig. 6.

MANUFACTURE OF ARROW-HEADS

Several publications give detailed explanations of arrow-head production in prehistoric Europe (for the bibliography: Eckhardt, 1996:66), and while old are still up to date. Two, three or four-shell casting

are used for trefoil so-called Scythian arrow-heads (multiple casting form: Černenko, 1981:95 fig. 71)3. Copper alloy arrow-heads are explained as first cast then subsequently smithed (Eckhardt, 1996:69). Their surface texture and sharpness of the edges reveals cutting and smithing. Casting forms have survived in Europe and Mesopotamia. Although iron probably was imported from South Asia to LIA Oman, in the early Muslim period the production of weapons again became important (Nicolle, 1983:231).

Iron arrow-heads could not be cast until the medieval period in Europe (Gedl, 2014:3), and were hammered to shape. Perhaps only a single raw-cast arrow-head came to light (Yule, 2018a:cat. no. 13). The edges of certain ones are 'hollow' smithed, i.e. when viewed in cross section the edges are concave to varying degrees. The tangs of some are crisply formed with sharp angles. The blades are more carefully formed than the tangs. No moulds came to light for the production of arrow-heads. At present there is no evidence of arrow-head production, but only of the melting down of arrow-heads.

SWORDS

Swords are both slashing and piercing weapons (Fig. 18 & Table 4). They are not standardised in size or shape during the Samad period. Short swords appear to have been primarily for piercing. The most numerous are 14 long daggers of the S13 class.

In his history of weapons in south-eastern Arabia, D. Potts writes a representation from the EIA into later periods based on what he knew (1998:191-199), whereas I am content to assemble the examples, new and old, without a diachronic text, because of the random nature of the finds (Yule, 2001 I:117-120).

Swords were the most prestigious Muslim period weapons. Arab poets write more frequently about swords than any other weapon (Schwarzlose, 1886:45, 54, 127). As in early medieval Europe, the Arabs exalt their weapons with names such as 'the thirsty' or 'does not deceive' (ibid, 194-5), conceivably a timeless custom. Some are believed to be endowed with supernatural powers, even souls. While doubtless the sword is esteemed, in the case with the Samad population, the bow and arrow are more numerous and were more commonly used. Several authors have touched on the development of sword length (Potts, 1998:202), but subsequently new sword categories have come to light in excavations.

One wore the sword hung from a bandolier (jamīlah) over the left or right shoulder (Schwarzlose, 1886:54). Schwarzlose understood the wearing of a sword at the waist as a late development in Arabia, since in the relevant texts that sometimes the chape touched the floor, 'in order to jump up more easily' (translated from 1886:207). It would be interesting if in the Arab world the sword was worn at the waist, and that in the late medieval period that this first happened in Oman. Medieval scabbard slides consisted of leather or wood and were colourfully painted (Schwarzlose, 1886:208-209). The corrosion of a sword blade from graves Bar1 and S2152 and others clearly shows a wood grain pattern from the scabbard. Other swords show the remains of metallic scabbard chapes (graves Am5 & S101125).

The S5 long sword from grave S101125 forms a special case (Fig. 18). Although it has a hooked grip, the blade is straight and is double-edged. The cutting edges have corroded off. Its hypothesised Roman manufacture (Potts, 1992b:295) seems unlikely, first owing to its actual shape. Second, Roman finds are extremely rare in central Oman. It appears to have been re-smithed as a slashing sword. This sword is neither a Roman gladius nor a spatha in classic form - main Roman sword types (for animal and bird-headed swords (spathae) see Ubl 1969, 308-309). The pommel of emperor Valerians spatha in the Sasanian relief at Bishapur I may have been fitted with a sphere (ibid,:fig. 191-295). Another sword with a hooked grip from Mlayḥa can be ignored since the blade has a rib, and is different from that under discussion. The non-standardised

3 See different authors under the keyword ‹Bronzeguß› in Reallexikon der Vorgeschichte herausgegeben von Max Ebert, Band 2, 1925:147-169.

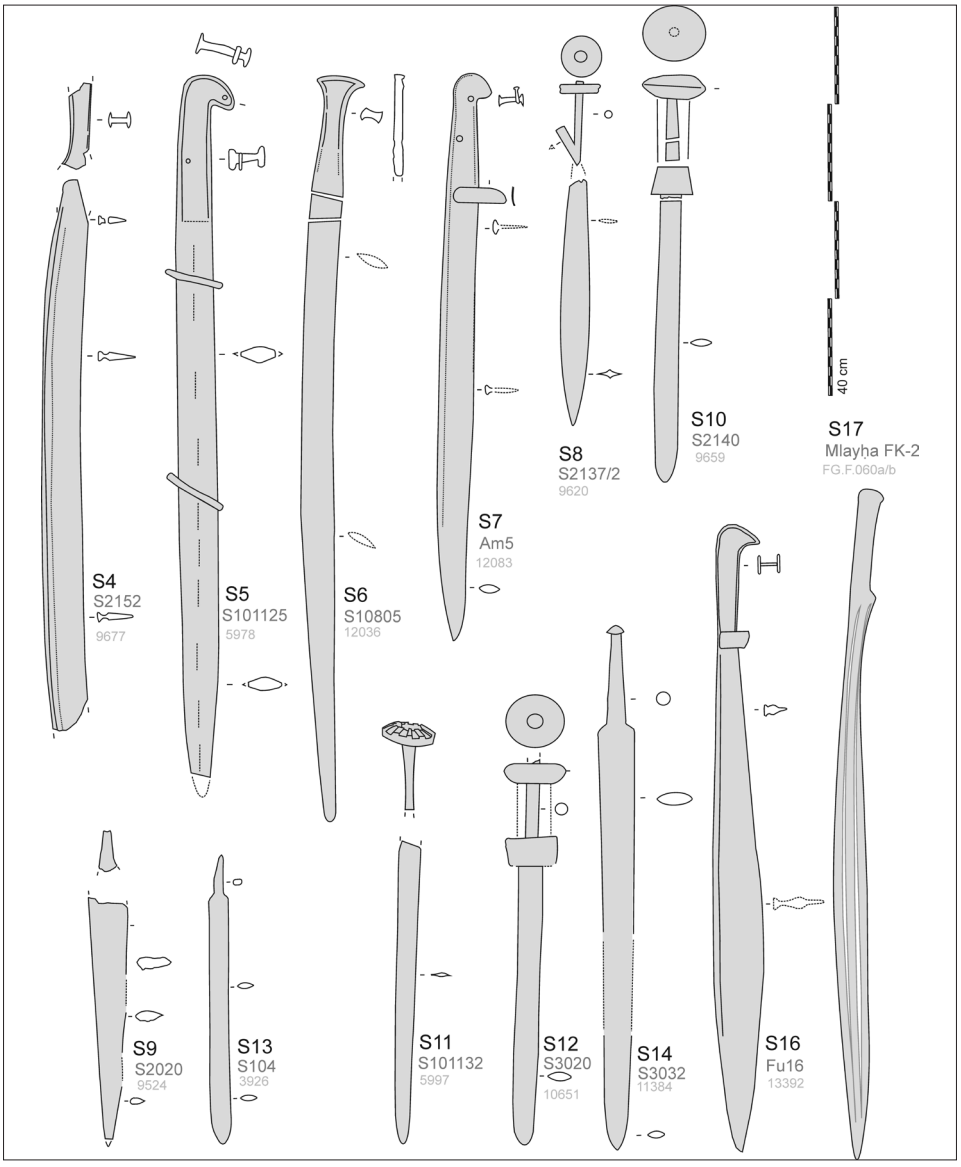

Figure 18. *Iron short swords and swords excavated from LIA graves mostly at Samad. The class, grave and DA numbers are identified for each sword.*

weaponry of the Auxilia (support troops) was locally coined. Its length suggests a use as a cavalry sword. As we know from other similar swords excavated from al-Fuwaydah (Yule, 1999:173-184 Figs. 30-41) the sword grip is smithed and not cast. Ancient bird-headed sword grips have been studied, some whittled and all representational in intent (Barnett 1983:59-74; cf. Also a true early example: Museum Rietburg, 1989:36 cat. no. 7: This shows a sword pommel carved of ivory of the 5th-4th century BCE from the Oxus temple in Tacht-i Sangin).

Other members of the S5 rim-flanged sword class at al-Fuwaydah cemetery and Sinaw grave G58 share common features. They seem to have been used rather than be just representational weapons. Evidently there is a considerable time-span, to judge from the 14C determinations in such graves. Al-Fuwaydah iron swords date to the late 1st millennium BCE and that in gr. S101125 to the 5th century CE (Mauro, 2018). It seems unlikely that Roman military activities in south-western Arabia would have any influence in central Oman

Table. 4: *Class definitions of Samad LIA long daggers, short swords and swords, all fashioned of iron. S1-S3 swords predate the Samad LIA.*

Class	Attributes
S4	sword, single-edged, curved sword, concave edge, flanged grip tongue
S5	sword, double-edged, rim-flanged, hooked pommel
S6	sword, double-edged, rim-flanged, concave grip
S7	short sword, single-edged, straight blade, heavy blade back
S8	short sword, double-edged, midrib, oblique guard, short grip, disc-shaped, pommel
S9	short sword, single-edged, grip tang, broad blade
S10	long dagger, double-edged, grip tang, heavy pommel and guard
S11	long dagger, double-edged, narrow blade, cog-like pommel
S12	long dagger, double-edged, heavy pommel and guard, wood grip
S13	long dagger, grip tang
S14	short sword, double-edged, in section the blade is biconvex, long grip tang circular in section
S15	sword accessories
S16	sword, single-edged, broad toward the point, rim-flanged grip
S17	sword, single-edged, blade concave *en face*, three arrisses the length of blade

(a hypothesis from D.T. Potts, 1998:196-197). In any case it seems clear that this is an indigenous sword form in south-eastern Arabia, because several contexted examples are known.4

CONCLUSIONS

For the topic of defence of the Samad LIA the nature of the local population, an overview of the forts, the weapons and tactics have been updated and discussed. The forts of the EIA differ from each other and contrast with those of the succeeding period. New in the Samad LIA for the smaller population are fortified settlements, some with defences formed by a wall and an inside room which have been likened to casemates. Also, they tend to lie close to natural water courses, rarely near aflāǧ, which for whatever reason are rare at this time. Prerequisite in both periods for such building projects is an organisation for village settlements. The thin population conditions the military structure and its organisation. It would be useful to more closely document the LIA fortifications than has been possible thus far since the data are most likely incomplete. These defences by no means profited from their EIA predecessors and show no improvements. The elaborate and regularly shaped PIR forts with corner bastions contrast with the LIA defensive architecture of the central part of south-eastern Arabia more than other kinds of relicts.

Our meagre evidence points to defence at Samad/Moyassar as probably being conceived around a small tribal militia. For well-organised military training and organisation evidence is lacking. The extant military equipment seems to be incomplete in the graves. An average warrior must have had a bow, leather quiver, arrows and a dagger, but most notably lacking in the graves are anti-horse weapons, slings, sling-stones, helmets, shields, bow cases and some kind of armour. Historically, the sword has had an appeal to the male mentality unjustly more than the bow and arrow. Archers generally were recruited from the lower social ranks and thus are socially stigmatised. Until the Parthian victory at Carrhae, largely as a result of archery, their Roman opponents never took them seriously enough. If some other organic grave goods survived, why not bows? Arguably the composite bow was standard. It may have held off attackers to a distance of 100 m. The excavated points belonged to arrows suitable

4 During the proof stage a new sword type came to light: a single-edged falcatta from Mileḥa area FK, tomb FK-2 (2017-FG.F.060a/b, a context of the 1st cent. BCE – 1st cent. CE (Overlaet, 2018: 30 cat. no. 27 – 28).

to shoot people, less so game. However, the heavily armed Samad population shows literally no injuries attributable to combat, which alone suggests at first glance an unchallenged existence.

The heterogeneity of the weapons suggests that itinerant craftsmen may have supplied them, presumably lacking markets at this time. Although tribal leaders rode horses, there is neither evidence for cavalry, offensive or for defensive. A role for women in all of this is difficult to determine. Possibly they might have been involved in the defence against sieges and in caring for the wounded. Analogies exist for women defending their homes when the men were away. The main point is that interpretations of the relatively few contexted weapons recovered can easily be challenged, first owing to their representativeness.

ACKNOWLEDGEMENTS

My thanks go first to Guillaume Gernez and Michel Mouton who invited me on April 2017 to participate in our conference on the archaeology of the Gulf in Kuwait. Other members of the conference provided excellent discussion partners, e.g. Abbès Zouache. Over the years the chair for Semitic Studies, Werner Arnold, provided a desk and other facilities which enabled my research. My thanks also go to the Bayer A.G. who excellently investigated the surface of the iron arrow-head, DA 9388. Thanks especially go to Michela Gaudiello, who took great pains to criticise two versions of this paper. I thank Reinhard Kammerer (Bonn), a soldier, who made several suggestions in the text. Further thanks go to Manfred Kunter for his diagnoses of the skeletons from central Oman over the years. Finally, this paper benefitted from the critical comments of Nasser al-Jahwari and the anonymous referees.

Many of the images discussed above appear in the internet image bank of the University of Heidelberg University Library, heidICON, in the pool 'SKVO Oman' (https://heidicon.ub.uni-heidelberg.de)

IMAGE CREDITS:

Figs. 1, 2, 3, 4, 14, Tables 1, 2, 4-8, 10, 12, 14: heidICON (Yule); Fig. 2.5: Yule & Abdali; Fig 2.1: adapted from Google Earth; 2.2: S. Kroll; 2.3: adapted from Boucharlat-Lombard, 1985:pl 67; 2.4: adapted from Petrie, 1998:248 fig 2; 2.5: Avanzini, 2013:353; 2.6: Karacic et al, 2018:29 fig. 2; 3.1: adapted from Korn et al, 2004:70 fig. 4; 2 -5: Yule; 6: adapted from Weisgerber & Heckes; Figs. 4-8, 10, 12, 14, Tables 1, 2, 4-6, 8: heidICON; Graph 4: data McLeod 1982; Figs. 9a & 9b: Bayer A.G.; Fig. 11: adapted from Zutterman 2003:158 fig 2; Fig. 13: I. Blome after CIH 23, Archaeological Museum Istanbul; Table 3: Yule, 2001 I:103-109.

BIBILIOGRAPHY

Al-Sālimī, Nūr ad-dīn 'Abdullāh bin Ḥumayd. 1969-72. *Tuḥfat al-a'yān bi Sīrat ahl 'Umān*, Cairo 1347-1350.

al-Ṭabarī, Abū Jaf'ār Muḥammed b. Jarīr .1958. *Ta'rikh al-rusul wa'l Mulūk*, translation M. H. Zottenberg, Paris.

Barnett, R. 1983. From Ivriz to Constantinople - A Study of Bird-headed Swords, in: U. Finkbeiner, R. Dittmann & H. Hauptmann (eds), *Beiträge zur Altertumskunde, FS Kurt Bittel*, pp. 59-74, Mainz: Zabern.

Bauer, T. 1992. *Altarabische Dichtkunst*, Wiesbaden: Harrassowitz.

Beeston, A. 1976. *Warfare in Ancient South Arabia (2nd-3rd centuries A.D.)*, Qahtan Studies in Old South Arabian epigraphy, 3, London: Luzac.

Benoist, A. 2013. *La vallée de Bithnah au cours de l'Age du Fer*, Oxford: BAR international series 2510.

Bosworth, C. 1986. Ḥarb v. Persia", *Encyclopedia of Islam* 3: 194-198.

Breton, J.-F. 1994. *Les fortifications d'Arabie méridionale du viie au ier siècle avant notre ère* (Archäologische Berichte aus dem Yemen, vol. 8) Berlin: Zabern.

Brown, F. 1937. A recently Discovered Compound Bow, *Seminarium kondakovianum* 9: 1-10.

Cahen, C. 1986. Ḥarb ii the caliphate", *Encyclopedia of Islam* 3: 181-184. Leiden: Brill.

Cahen, C. 1991. Djaysh", *Encyclopedia of Islam* 2: 504-509. Leiden: Brill.

Černenko, E. 1981. *Bow and Arrow, Scythians,* Kiev: Akademiia nauk Ukrainskoĭ SSR. Institut arkheologii.

Cheshire, E. 2014. Cuir bouilli armour", in S. Harris (ed.), *Why leather? The material and cultural dimensions of leather*, pp. 41-76, Leiden: Sidestone.

Cleuziou, S. 1974. *Les pointes de fleche en metal au proche orient*, unpublished doctoral thesis Paris.

Coulston, J. 1985. Roman Archery Equipment, in: M. Bishop (ed.), *The Production and Distribution of Roman Military Equipment. Proceedings of the second Roman Military Equipment Seminar*, pp. 220-366, Cambridge: BAR.

van Deelen, L. 1993. *On the Weight of Arrow-heads Weight as a Criterion for a Distinction between Arrowheads and Javelin Heads*, unpublished paper, 7 pages.

De Waele, A., 2005. Composite Bows at ed-Dur (Umm al-Qaiwain), *Arabian Archaeology and Epigraphy* 16: 154-160.

Döpper, S. 2018. Towers and Ditches in Third Millennium BC Eastern Arabia: a View from Building II at Bat, Sultanate of Oman", *Paléorient* 44(1): 119-131.

Douillet, G. 1991. Furūssiya, *Encyclopedia of Islam* 2: 952-954. Leiden: Brill.

Eckhardt, H. 1996. *Pfeil und Bogen: eine archäologisch-technologische Untersuchung zu urnenfelder- und hallstattzeitlichen Befunden*, Espelkamp: Leidorf.

Editors. 1993. "Murū'a", *Encyclopedia of Islam* 7: 636-638. Leiden: Brill.

Eggert, M. 2001. *Prähistorische Archäologie Konzepte und Methoden*, Munich: Wilhelm Fink.

Faris, N. & Elmer, R. 1945. *Arab Archery - An Arabic Manuscript of about A.D. 1500 'A book on the Excellence of the Bow and Arrow' and the Description Thereof, Translated and Edited by Nabih Amin Faris and Robert Potter Elmer*, Princeton: Princeton.

Foulkes, C. J. 1988. *The Armourer and his Craft,* London: Methuen (reprint).

Forrest, S. 2016. *The Age of the Horse…* Atlantic: London.

Gedl, M. 2014. *Die Pfeilspitzen in Polen*, Prähistorische Bronzefunde, V, 6, Stuttgart: Steiner.

Gernez, G. & Giraud, J. 2017. *Taming the Great Desert Adam in the Prehistory of Oman,* Muscat: Ministry of Heritage and Culture.

Goldman, B. 1994. Graeco-Roman Dress in Syro-Mesopotamia", in: J. Sebesta & L. Bonfante (eds), *The World of Roman Costume*. Pp. 163-181, Madison: University of Wisconsin.

Griffiths, W. 1985. The Sling and its Place in the Roman Imperial Army", in: M. C. Bishop (ed.), *The Production and Distribution of Roman Military Equipment, Proceedings of the 2. Roman Military Equipment Research Seminar, London*: pp. 255-279, Oxford: British archaeological reports.

Härke, H. 1997. The Nature of Burial Data", in: C. Jensen & K. Nielsen (eds), *Burial & Society the Chronological and Social Analysis of Archaeological Burial Data*, pp. 19-27, Aarhus: Aarhus Univ. Press.

Hellmuth Kramberger, A. 2016. *Die Pfeilspitzen aus Tall Šēh Hamad/Dūr-Katlimmu von der mittelassyrischen bis zur parthisch-römischen Zeit in ihrem westasiatischen und eurasischen Kontext*, Wiesbaden: Harrassowitz.

Hitti, P. 1966. The Origins of the Islamic State, being a translation from the Arabic accompanied with annotations, geographic and historic notes of the *Kitâb futûḥ al buldân of al-Imâm abu-l 'Abbâs Aḥmad ibn-Jâbir al-Balâdhuri*, Beirut.

Junkelmann, M. 1986. *Die Legionen des Augustus: der römische Soldat im archäologischen Experiment*, Mainz am Rhein: von Zabern.

Karacic, S., Händel, M., Hammer, E. & Magee, P. 2018. The Architecture of the Iron Age II Fortified Settlement at Muweilah (Sharjah, United Arab Emirates), *Arabian Archaeology and Epigraphy* 29: 27-54.

Khadduri, M. 1986. "ḥarb", *Encyclopedia of Islam* 3: 180-181. Leiden: Brill.

King, G. 2001. The Coming of Islam and the Islamic Period in the U.A.E.", in: I. al-Abed, P. Hellyer (eds), *United Arab Emirates A new perspective*, pp. 70-97, London: Trident.

Klein, H. 1938. *Kapitel 33 der anonymen arabischen Chronik Kašf al-Ġumma al Ǧāmi' li-ahbar al-Umma* betitelt *Ahbār ahl 'Omān min auwal islāmihim ilā'htilāf kalimatihim (Geschichte der Leute von Omān von ihrer*

Annahme des Islam bis zu ihrem Dissensus), Diss. Univ. Hamburg.

Kolias, T. 1968. *Byzantinische Waffen - Ein Beitrag zur byzantinischen Waffenkunde von den Anfängen bis zur lateinischen Eroberung*. Vienna: Byzantine Vindobonensia, vol. 17.

Korfmann, M. 1972. *Schleuder und Bogen in Südwestasien von den frühesten Belegen bis zum Beginn der historischen Stadtstaaten*, Bonn: Habelt.

Korn, L., Häser, J., Schreiber, J., Gangler, A., Nagieb, M., Siebert, S. & Buerkert, A. 2004. Ṭīwī, ash Shab and Wādī Ṭīwī: The Development of an Oasis on the North-eastern Coast of Oman, *Journal of Oman Studies* 13: 57-90.

Kroll, S. 1981. Die Burgfestung Lizq-1", in: G. Weisgerber (ed.) Mehr als Kupfer in Oman, *Der Anschnitt* 5-6: 226-231.

Kroll, S. 2013. The Early Iron Age Lizq fort, Sultanate of Oman, translated and revised by Paul Alan Yule", *Zeitschrift für die Kultur außereuropäischen Kulturen*, vol. 5, pp. 159-220.

Lombard, P. 1985. *L'Arabie orientale à l'age du fer thèse présentée pour la doctorat en anthropologie, ethnologie, préhistoire (spécialité: archéologie orientale)*, unpublished doctoral dissertation, Paris 1.

Lorimer, J. 1908-15, *Gazetteer of the Persian Gulf, Omān and Central Arabia,* 2 vols., 6 fasicles, Calcutta: Supt. Government Printing, reprint Gregg International.

Luik, H., 2006. For Hunting or for Warfare? Bone Arrowheads from the Late Bronze Age Fortified Settlements in Eastern Baltic, *Estonian journal of archaeology* 10: 132-140.

Magee, P. 2016. rev. of Yule 2014, *Antiquity* 90(349): 253-254.

Magee, P., Händel, M., Karacic, S., Uerpmann, M. & Uerpmann, H.-P. 2017. Tell Abraq during the Second and First Millennia BC: Site Layout, Spatial Organisation, and Economy", *Arabian archaeology and epigraphy* 28(2): 209-237.

de Maigret, A. 1976. *Le lance nell'Asia anteriore nell'Età del Bronzo. Studio tipologico*, vol. 47, Rome: Istituto di Studi del Vicino Oriente, Studi semitici.

Maraqten, M. 2015. Hunting in Pre-Islamic Arabia in Light of the Epigraphic Evidence, *Arabian archaeology and epigraphy* 26: 208-234.

Mauro, F. 2018. Late Iron Age Grave 58 from the Sināw Area (al-Sharqiyyah, Sultanate of Oman): a Warrior and his Historical Context, *Proceedings Seminar of Arabian Studies* 48: 235-242.

McLeod, W. 1970. *Composite bows from the tomb of Tut'ankhamūn,* Oxford: Griffith Inst.

McLeod, W. 1982. *Self Bows and other Archery Tackle from the Tomb of Tut'ankhamūn*, Oxford: Griffith Inst.

Mouton, M. 2008. *La péninsule d'Oman de la fin de l'âge du fer au début de la période sasanide (250 av. - 350 ap. JC)*, Oxford: BAR International Series 1776, (Paris dissertation of 1992).

Mouton, M. & Schiettecatte, J. 2014. *In the Desert Margins the Settlement Process in Ancient South and East Arabia*, Rome: Bretschneider.

Mouton, M., Tengberg, M., Bernard, V., Le Maguer, S., Reddy, A., Soulié, D., Le Grand, M. & Goy, J. 2012. Building H at Mleiha: New Evidence of the Late Pre-Islamic Period D Phase (PIR.D) in the Oman Peninsula (Second to Mid-Third Century AD), *Proceedings Seminar of Arabian Studies* 42: 205-222.

Mühle, B. & Schreiber, J. 2012. Ein römisches Schwert aus dem Gräberfeld von 'Umm al-Mā'", in: Baker, H., Kaniuth, K., Otto, A. (eds), *Stories of long ago Festschrift für Michael Roaf*, pp. 373-383, Winona Lake, in: Ugarit.

Nicolle, D. 1983. Arms Manufacture and the Arms Trade in South-eastern Arabia in the Early Muslim Period, *Journal of Oman Studies* 6(2): 231-238.

Nicolle, D. 2004. Armour, in C.E. Bosworth "Silāḥ", *Encyclopedia of Islam* 12: 737-746. Leiden: Brill.

Overlaet, B. 2018. *Mleiha an Arab kingdom on the caravan trails, discoveries in Sharjah emirate – U.A.E. [exhibition] 30.10-30.12.2018,* Brussels: Royal Museums of Art and History.

Overlaet, B. & Yule, P. 2018. A Late Pre-Islamic Bowl with Levantine-inspired Decoration from ed-Dur", *Arabian Archaeology and Epigraphy* 29: 172-184 https://doi.org/10.1111/aae.12116

Potts, D.1992 . *The Arabian Gulf in antiquity*, 2 vols. Cambridge: Cambridge.

Potts, D.1998 . Some Issues in the Study of the Pre-Islamic Weaponry of Southeastern Arabia, *Arabian archaeology and epigraphy* 9: 182-208.

Potts, D., Weeks, L., Magee, P., Thompson, E. & Smart, P. 1996. Husn Awhala: A Late Prehistoric Settlement in Southern Fujairah, *Arabian Archaeology and Epigraphy* 7(2): 214-239.

Rausing, G. 1967. *The Bow: Some Notes on its Origin and Development*, Acta archaeologica Lundensia ser. 8, no. 6, Bonn: Habelt.

al-Rawi, A. 2011. Die Bronzewaffen aus der Königsgruft von Tall Mišrife/Qaṭna: Räumliche Verteilung und funktionales Spektrum", in: P. Pfälzner (ed.), *Interdisziplinäre Studien zur Königsgruft von Qaṭna*, vol. 1, pp. 311-327, Wiesbaden: Harrassowitz.

Robin, C. & Antonini, S. 2017. Le cheval dans l'Arabie méridionale antique", *Arabian humanities*, placed online 31 May 2017, downloaded 4 September 2018, from http://cy.revues.org/3284 ; DOI 10.4000/cy.3284

Rosenzweig, K. 1968. Dentition of Bedouins in Israel: I, Epidemiology", *Journal Dental Research* 3: 407-410.

Ross, E., 1874. Annals of Omán, from Early Times to the Year 1728 A.D. from an Arabic MS by Sheykh Sirhā'n b. Sa'ī'd bin Sirhā'n bin Muḥammad, of the Benú Alí tribe of Omán, translated and annotated", *Journal Asiatic Society of Bengal* 43(1): 111-196.

Rutten, K. 2007. The Roman Fine Wares of ed-Dur (Umm al-Qaiwain, U.A.E.) and their Distribution in the Persian Gulf and the Indian Ocean, *Arabian Archaeology and Epigraphy* 18: 8-24.

Sabin, P. 2007. "Battle", in P. Sabin, H. van Wees & M. Whitby (eds.), *The Cambridge History of Greek and Roman Warfare*, vol. 1, pp. 399-460, Cambridge: CUP.

Schippmann, K. 1998. *Geschichte der alt-südarabischen Reiche*, Darmstadt: Wissenschaftliche Buchgesellschaft.

Schreiber, J. 2005. Archaeological Survey at Ibrā' in the Sharqīyah, Sultanate of Oman, *Proceedings Seminar of Arabian Studies* 35: 255-270.

Schwarzlose, F. 1886. *Die Waffen der alten Araber aus ihren Dichtern dargestellt...,* Leipzig: Hinrichs'sche.

Seidl, U. & Stol, M. 2015. Waffen im alten Mesopotamien, *Bibliotheca orientalis* 72(5-6): 613-625.

Thornton, C. & Pigott, V. 2011. Blade-type Weaponry of Hasanlu Period IVB", in: M. de Schauensee (ed.), *Peoples and Crafts in Period IVB at Hasanlu, Iran, Hasanlu Special Studies*, vol. IV, pp. 135-182, Philadelphia: University Museum.

Toral-Niehof, I., 2014. Talking about Arabic Origins: The Transmission of the Ayyām al-'arab in Kūfah, Baṣrah and Bagdad", in J. Scheiner & D. Janos (eds.), *The Place to Go Contexts of Learning in Baghdād, 750-1000 C.E.*, pp. 43-69, Princeton: Darwin.

Tyan, E. 1991. Diya, *Encyclopedia of Islam* 2: 334-340, Leiden: Brill.

Ubl, H. 1969. *Waffen und Uniformen des römischen Heeres der Prinzipatsepoche nach den Grabreliefs Noricum und Pannoniens*, unpublished doctoral dissertation, Vienna University.

Viré, F. 1991. Faras, *Encyclopedia of Islam* 2: 784-487. Leiden: Brill.

Webb, W. 1957. *The Development of the Spearthrower*, vol. 2, Lexington, University of Kentucky occasional papers in anthropology.

Weeks, W., Cable, C., Franke, K., Karacic, S., Newton, C., Roberts, J., Stepanov, I., McRae, I., Moore, M., David-Cuny, H., Al Aali, Y., Boraik, M. & Zein, H. 2018. Saruq al-Hadid: a Persistent Temporary Place in Late Prehistoric Arabia, *Journal of World Archaeology* 29 Aug. 2018 online, 1-26, downloaded 20.09.2018, https://doi.org/10.1080/00438243.2018.1491324

Weisgerber, G. 1981. Mehr als Kupfer in Oman", *Der Anschnitt*, vol. 33, pp. 174-263.

Wiethase, H. 2016. *Pfeile der Welt Welt der Pfeile*, Wettin-Löbejün: Wiethase Verlag.

Wilkinson, J. 1977. *Water and Tribal Settlement in South-east Arabia, a Study of the aflāj of Oman*, Oxford: Clarendon.

Wilson, J., (1951), *The culture of ancient Egypt*, Phoenix: Chicago.

Yadin, Y. 1963. *The Art of Warfare in Biblical Lands*, London: Weidenfeld and Nicolson

Yadin, Y. 1966. *Masada: Herod's Fortress and the Zealots' Last Stand*, New York: Random House.

Yule, P. 2001. *Die Gräberfelder in Samad al Shān (Sultanat Oman) Materialien zu einer Kulturgeschichte, Deutsches Archäologisches Institut*, Orient-Archäologie vol. 4, Rahden/Westfalia: Marie Leidorf.

Yule, P. 2007. *Himyar–Die Spätantike im Jemen/Late antique Yemen*, Aichwald: Lindenbeck.

Yule, P. 2013a. Late Pre-Islamic Oman: The Inner

Evidence – the Outside View, in: M. Hoffmann-Ruf & A. al-Salami (eds.), *Studies on Ibadism and Oman, Oman and Overseas*, vol. 2, pp. 13-33, Hildesheim: Olms.

Yule, P. 2013b. *Late Antique Arabia Ẓafār, Capital of Ḥimyar, rehabilitation of a 'decadent' society, excavations of the Ruprecht-Karls-Universität Heidelberg 1998–2010 in the highlands of the Yemen*, Abhandlungen Deutsche Orient-Gesellschaft, vol. 29, Wiesbaden: Harrassowitz.

Yule, P. 2014. *Cross-roads Early and Late Iron Age South-eastern Arabia*, Abhandlungen Deutsche Orient-Gesellschaft, vol. 30, Wiesbaden: Harrassowitz.

Yule, P. 2016. Valorising the Samad Late Iron Age", *Arabian Archaeology and Epigraphy* 27(1): 31-71.

Yule, P. 2017. Al-Moyassar is the Gift of the *falaj*", in: W.Y. al-Tikriti & P. Yule (eds.), *Water and Life in Arabia Conference*, Abu Dhabi, pp. 87-101.

URL:https://uni-heidelberg.academia.edu/paulyule/Papers-Arabia

Yule, P. 2018a. The finds", in: P. Yule & G. Gernez (eds.), *Early Iron Age Metal-working Workshop in the Empty Quarter, Sultanate of Oman*, Universitätsforschungen zur prähistorischen Archäologie, 311, Bonn: Habelt, pp. 33-146.

Yule, P. 2018b. Toward an Identity Archaeology for the Samad Period Population (Sultanate of Oman)", *Zeitschrift für Orient-Archäologie* 11: 438-486.

Yule, P. & al-Rasibi, Kh. 2015. Umq al-Rabaḥ, al-Sharqīyah, unpublished internal report for the Ministry of Heritage and Culture, Sultanate of Oman, 13.04.2015",from http://archiv.ub.uni-heidelberg.de/propylaeumdok/volltexte/2017/3675

Yule, P. & Pariselle, C. 2016. Silver Phiale Said to be from al-Juba (al-Wusṭa Governorate) - an Archaeological Puzzle", *Arabian Archaeology and Epigraphy* 27: 153-165.

Yule, P. & Robin, C. 2005-6. Himyarite Knights and Infantrymen, Two Reliefs, *Arabia* 3: 261-271, Figs. 157-169 on pp. 358-363.

URL: http://archiv.ub.uni-heidelberg.de/propylaeumdok/volltexte/2008/112/

Yule, P. & Weisgerber, G. 2015. The Cemetery at al-Akhḍar near Samad al-Shān in the Sharqīya (Oman), in: P. Yule (ed.), *Archaeological Research in the Sultanate of Oman*, Der Anschnitt, pp. 111-178.

Zutterman, C. 2003. The Bow in the Ancient Near East, a Re-evaluation of Archery from the Late 2nd Millennium to the End of the Achaemenid Empire, *Iranica antiqua* 38: 119-165.

CONTRIBUTORS ADDRESSES:

Paul A. Yule
Sprachen und Kulturen des Vorderen Orients - Semitistik Ruprecht-Karls-Universität Heidelberg Schulgasse 2 D-69117 Heidelberg, Email: paul.yule@t-online.de