

Tales of Three Worlds

Archaeology and beyond:
Asia, Italy, Africa

A tribute to Sandro Salvatori



Edited by

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Title Page photo: Sandro Salvatori (on the right) with Iranian colleagues Ali Hakemi (centre) and Ismail Bayani (on the left) at Shahdad, a Bronze Age site (Iran 1976)

Cover illustrations: Sandro Salvatori during the excavation of the Central Quarters at Shahr-e-Sokhta (Iran) (back cover photo); painted decoration on a pot from the Bronze Age site of Shahr-e-Sokhta (Iran) (background)

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Prehistoric Fishing along the Coasts of the Arabian Sea: A Short Overview from Oman, Balochistan and Sindh (Pakistan)

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Abstract: Communities of fishers and shellfish gatherers settled along the coasts of the Arabian Sea since the end of the 8th millennium BP. Traces of their presence are known from both the Sultanate of Oman and Pakistan. The surveys and excavations carried out in Oman since the 1970s, and Las Bela and Sindh (Pakistan) since the beginning of the 2000s, led to the discovery of an impressive number of shell middens whose characteristics vary according to the coastal zone where they are located. The present paper discusses the archaeological evidence of prehistoric fishing in the aforementioned region. The archaeological evidence relies on characteristic material culture and faunal remains, the radiocarbon chronology of the sites, the importance they play in the reconstruction of the Holocene Arabian Sea coastal landscapes, and the intensity of peopling during different periods of habitation.

Keywords: Arabian Sea, Holocene, shell middens, fishing gears, chronology

Introduction

Fishing has played an important role in the diet of many prehistoric communities settled along river courses and sea coasts in many periods of prehistory (Radcliffe 1921; Cleyet-Merle 1990; Grøn 2018). Regarding archaeological sites, proxies of fishing activities are considered to be the presence of fish bones and material culture remains, among which are fishing implements (i.e. fish-hooks, net-sinkers, etc.: Charpentier and Méry 1997; Prowse 2010; Maigrot *et al.* 2014; Rosenberg *et al.* 2016), stone alignments (Vernet 2016) and, in some cases, whenever environmental conditions have favoured their preservation, fishing traps and wooden structures (Fischer 2007; Lozovski *et al.* 2013; Quintana Morales and Horton 2014; Billard and Bernard 2016).

The reconstruction of past freshwater fishing techniques has been proposed thanks to ethnoarchaeological information acquired from the study of human settlements located along river courses, where traditional fishing was practised for the capture of this important food resource until a few years ago. In this respect, the Danube has undoubtedly played a major role in Balkan Europe (see Bosić 1982; Bartosiewicz *et al.* 2008). Regarding seacoast environments we can rely upon many examples provided by the researches carried out along the shores of the Atlantic Ocean in Europe and North Africa (Fano 2007; Morales-Muñiz and Roselló-Izquierdo 2008), the Baltic Sea

and Scandinavia, Denmark and Finland in particular (Enghoff 1986; Eriksson *et al.* 2003; Lübke *et al.* 2007; Grøn 2015). However, the interpretation of prehistoric fishing techniques is always somewhat problematic (Colley 1987).

The importance played by fishing in the diet of the prehistoric communities has been interpreted mainly thanks to the study of the faunal remains retrieved from the excavation of oceanic coastal sites (see e.g. Beech 2004; O'Connor *et al.* 2018), though other scientific methods have sometimes been employed (Bonsall *et al.* 2005).

Dietary isotopic studies can inform us of the subsistence strategies followed by prehistoric communities. Carbon and nitrogen stable isotope analysis on collagen extracted from skeletal tissues, among which are bone and dentine, are considered a reliable tool for inferring information about the diets of prehistoric humans and animals. They represent an especially useful analytical method for exploring marine vs. terrestrial protein input, therefore assessing marine resource exploitation for human diet (Lee-Thorp 2008; Lillie and Budd 2011; Schulting 2011; Makarewicz *et al.* 2015; Salazar-García *et al.* 2018).

Indeed, bulk collagen stable carbon and nitrogen isotope analysis can be successfully used to estimate the relative contribution of marine versus C3-based

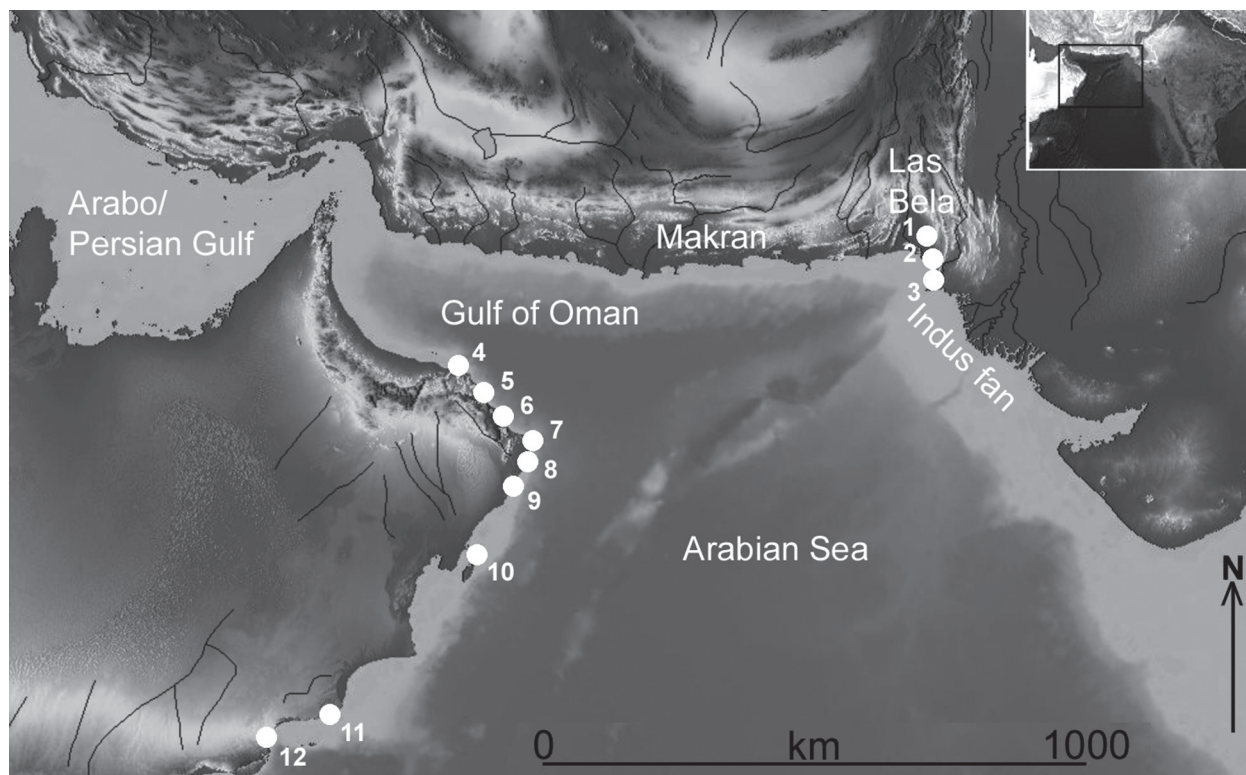


Figure 1. Distribution map of shell midden sites mentioned in the text: Lake Siranda (n. 1), Daun (n. 2), Sonari (n. 3), Ra's al Hamrā (n. 4), Khor Milkh (n. 5), Ash Shab (n. 6), Ra's al Junayz (n. 7), Ra's al Khabbah (n. 8), Suwayh (n. 9), Masirah (n. 10), Sharbitat (n. 11), Natif (n. 12).

terrestrial resources in coastal populations due to distinctive isotopic signals. However, samples of bone tissues must be screened according to established quality criteria for collagen preservation. For instance, samples with C:N ratios outside the 2.9–3.6 range must be discounted, therefore, considering that the expectation of collagen preservation in desertic climate is low, the feasibility of this approach in the area under discussion needs to be tested.

However, whilst stable isotope investigations on prehistoric diets increased exponentially during the last decade in some areas, such as the Mediterranean basin (Mannino *et al.* 2012; Salazar-García *et al.* 2018, and bibliography therein), this field remains unfortunately underexplored in the Arabian Sea and the Arabo/Persian Gulf (Munoz *et al.* 2017: 190). In this region other non-isotopic dietary proxies have been commonly utilised for assessing intensive human marine resource exploitation during prehistory. Among these are shell middens, large amounts of fish bones and fishing implements (fish-hooks, net-weights and other types of fishing gears) in the archaeological assemblages, coupled with unique environmental conditions that, even during the most humid phase of the Early Holocene (Sanyal and Sinha 2010: 172), were indeed less favourable to agriculture and herding.

Most probably geography, climate, monsoon winds and arid environment (Stewart and Pilkey 1966) clearly influenced the amount of marine resource available, which were exploited for consumption by the prehistoric communities of the Arabian Sea.

Regarding the coasts of the Arabian Sea, another source of information is provided by historic narratives of Hellenistic and Roman times that report the presence of groups of fish-eaters, or *ichthyophagoi* (McCrinkle 1972). However, the available archaeological evidence suggests that the presence of fishers and molluscs gatherers in this region is to be driven back to the Early Holocene (Charpentier *et al.* 2016; Biagi *et al.* 2018).

The scope of this paper is to update and discuss the available evidence for prehistoric fishing along the Arabian Sea coasts of the Sultanate of Oman, Las Bela and Sindh in Pakistan (Figure 1).

Geographic and environmental setting

The region covered in this study is part of a large territory that includes the Arabo/Persian Gulf, the Gulf of Oman, and the south-easternmost part of the Arabian Peninsula. The rapid urban development of the last decades was determined mainly by the boost of oil



Figure 2. The town of Sūr (Oman) before urban development, with the location of the shell midden discovered inside the Portuguese fort (arrow) (helicopter photograph by R. Salm, 1991).

business (Davies and Stevens 1992). It caused a dramatic intensification of archaeological research and rescue operations fortunately promoted by the illuminate authorities of several countries, in particular those of the United Arab Emirates (Potts 1997) and the Sultanate of Oman. Along the northern coast of the Gulf, the exploration was much less intensive mainly due to insecurity and political problems as well as landscape difficulties. Apart from the surveys conducted by the Italian Archaeological Expedition between 2007 and 2014 in Las Bela and the Indus delta, and the researches carried out in the 1980s by the French Archaeological Expedition in Makran (Sanlaville *et al.* 1991), no attention has ever been paid to the prehistoric peopling of these regions. The only exception is the geoarchaeological survey made by the late Professor Abdul Rauf Khan of Karachi University in the 1970s (Khan 1979).

Broadly speaking all this wide territory shares comparable environmental conditions, with arid landscapes, sandy and gravelly desert coastlines (Snead 1969). In many areas, the absence of soil and the scarce vegetation favours the discovery of traces of past human activities and the identification of even ephemeral archaeological sites. In particular, prehistoric shell middens have been found along the shores of ancient lagoons at present dried (Berger *et al.* 2013; Biagi *et al.*

2018). In the Sultanate of Oman they are often located at the top of rocky headlands protruding towards the sea, in correspondence with wadis' estuaries (Figure 2).

Palaeoenvironmental reconstructions have shown that, at the beginning of the Holocene, the territory was characterised by a more humid climate with extensive mangrove ecosystems at wadis' estuaries, a few of which have survived up to the present (Berger *et al.* 2005). However, the presence of mangal environments in different periods of the Holocene is often inferred by the composition of the faunal and vegetation assemblages retrieved from shell middens. Dumped amongst fish bones and shell remains, fish hooks made from shell (Figure 3) or bone gorges (Figure 4), and stone net-sinkers obtained from notched or grooved beach pebbles are commonly found. They testify for a subsistence strategy strongly based on the collection of seafood, fishing and the exploitation of mangal resources (Woodman 2013).

The Gulf fish-eaters and their locations

The research carried out since the beginning of the 2000s in Sindh and Las Bela in Balochistan have shown that shell middens and fishermen sites do exist also along the northern coast of the Arabian Sea, a territory

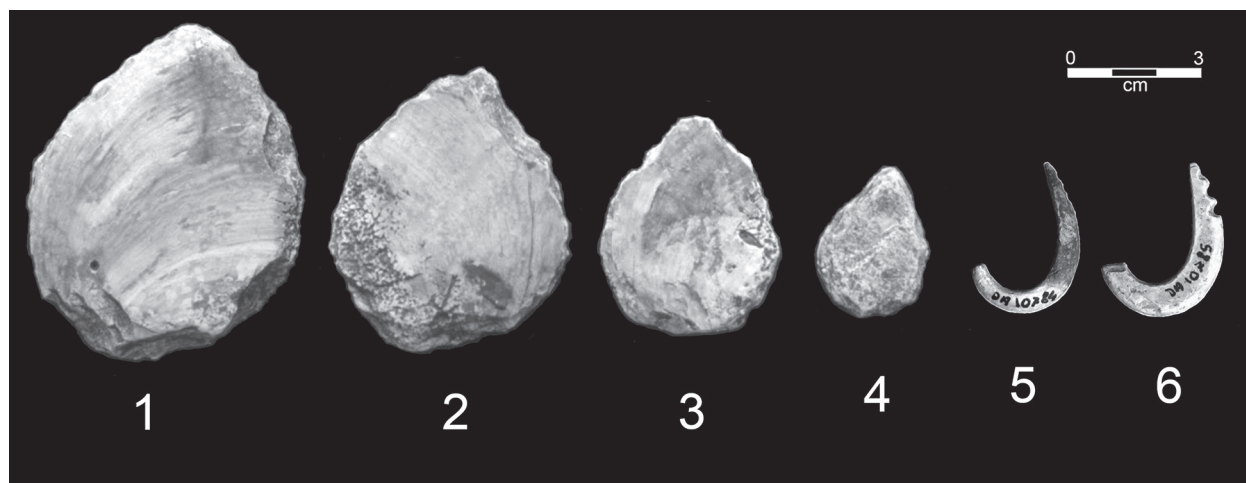


Figure 3. RH-6 (Muscat, Oman): Rough-outs and finished shell hooks from the 1988 excavations at the site (photograph by P. Biagi, 1990).

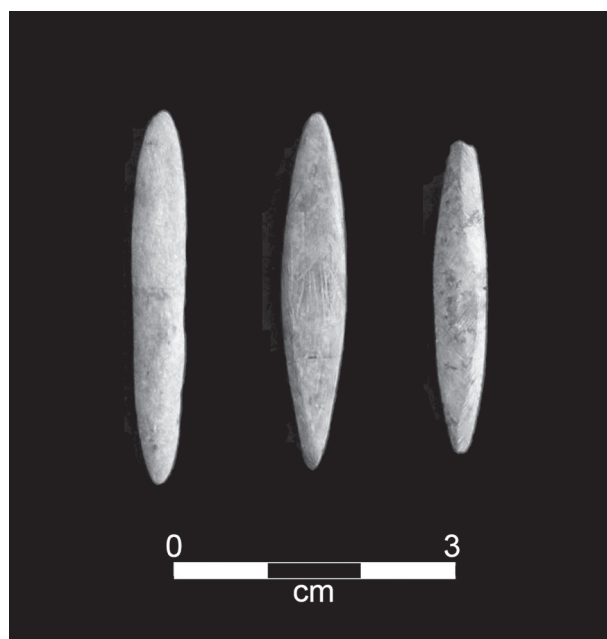


Figure 4. RH-5 (Muscat, Oman): Bone fishing gorges (photograph by P. Biagi, 1990).

still nowadays very rich in fish resources (Qureshi 1955; Siddiqi 1956). According to the classical authors Las Bela was inhabited by groups of Oreitae fish-eaters, while Makran (ancient Gedrosia) was settled by tribes of Ichthyophagoi (Arrian 1966).

The discoveries made from the 1980s onwards have greatly improved our knowledge of the prehistoric communities of fish-eaters who settled along the coasts of the Gulf of Oman and the Arabo/Persian Gulf between the Middle Holocene and the Bronze Age, at least as regards the Oman Peninsula and the United

Arab Emirates (Potts 1997). However, no tangible archaeological evidence of their presence has ever been reported from the northern coast of the Indian Ocean until the beginning of the 2000s, with the exception of those described from the coast of Makran (Desse and Desse-Berset 1999). The first steps towards a wide scale interpretation of the problem were put forward ca a decade ago (Biagi 2008; Boivin and Fuller 2009), following the discovery of the first shell middens on the shores of the Bay of Daun in Las Bela province of Balochistan (Biagi *et al.* 2012).

We know that navigation along the coasts of the Arabo/Persian Gulf began around the middle of the 7th millennium BP, as the discoveries made at as-Sabiyah, in Kuwait, clearly show (Carter and Crawford 2010). Moreover, a good set of radiocarbon dates suggests that seafaring along the ancient Indus Delta coastline started roughly in the same period (Biagi *et al.* 2018). At present we do not have any evidence for sea crossings between the two sides of the Gulf of Oman during the Middle Holocene, though new discoveries made in central Oman suggest that transoceanic navigation was already practised by Kot Diji culture groups around the beginning of Bronze Age (Méry *et al.* 2017). However, navigation was undoubtedly active along the coast of Oman already by the beginning of the 7th millennium BP as suggested by a radiocarbon date from SM-10 at Ra’s Dah in the Island of Masirah (Charpentier *et al.* 2013: 4).

Las Bela and Sindh (Pakistan)

The surveys carried out during the last fifteen years along the coast of Las Bela and its interior led to the discovery of many shell middens and shell scatters, among which are those of the Bay of Daun (Biagi *et al.*

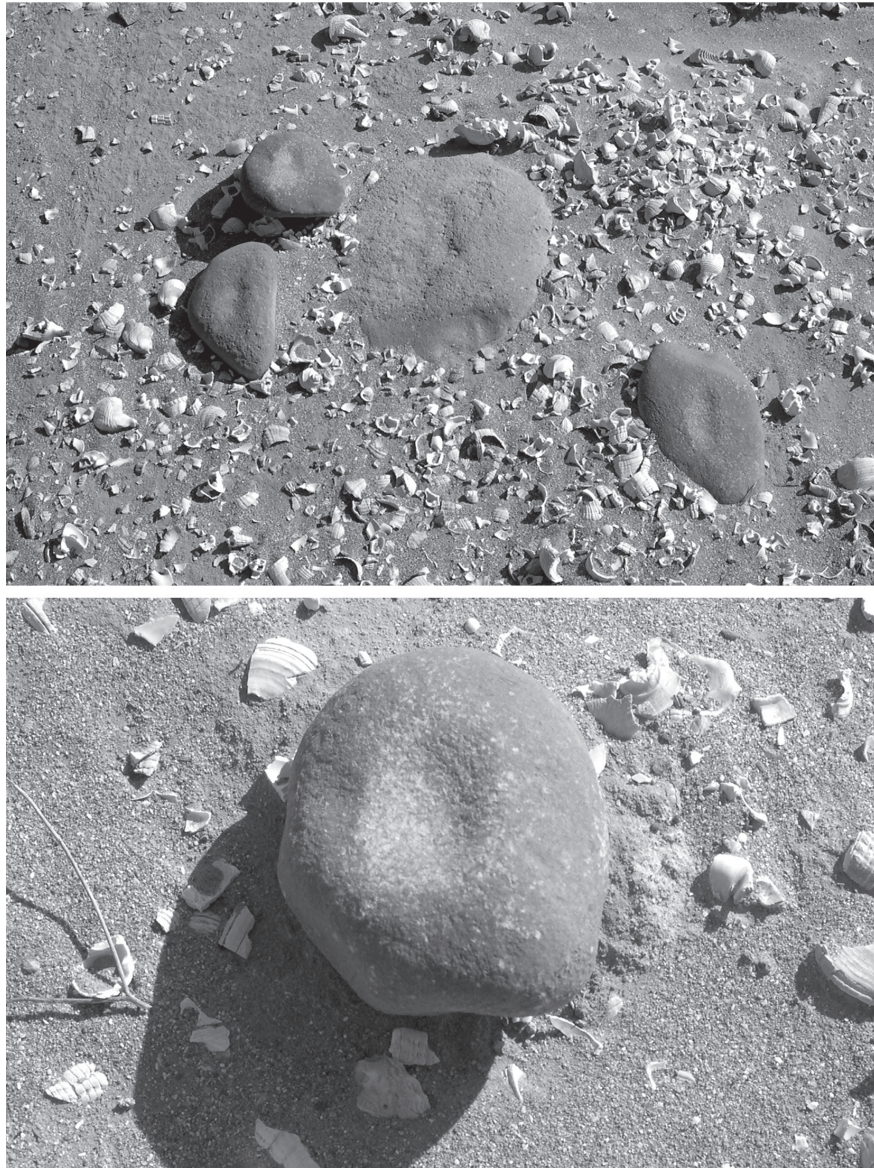


Figure 5. Daun-1 (Las Bela, Balochistan): pitted crushing stones on the surface of the site (photographs by P. Biagi, 2004).

2012), Ras Gadani and Ras Phuuri (Biagi *et al.* 2013), and the ancient shores of the so-called Lake Siranda (Biagi 2013; Biagi *et al.* 2018).

Seventeen out of the 29 shell middens discovered around the Bay of Daun were radiocarbon dated from mangrove and marine shells to build a first chronological time-scale and compare it with that of the Omani shell middens. The results showed that the Daun sites are to be subdivided into two main clusters, the first of which belongs to the 7th millennium BP aceramic Neolithic, the second to different periods of the 5th millennium BP Bronze Age Indus Civilization.

Apart from many pitted crushing stones, a concentration of which has been recorded from the surface of

site Daun-1 (Figure 5), fishing tools are represented by only 4 net-sinkers (Figure 6, n. 5). Two come from 2 Neolithic sites radiocarbon dated to the middle of the 7th millennium BP by *T. palustris* (Daun-111: GrN-31493: 6590±45 BP; Daun-1: GrN-26368: 6380±40 BP), 2 from 2 Bronze Age shell middens (Daun-5: GrN-28801: 4900±35 BP; Daun-3: GrN-27954: 4100±30 BP). The sites consist of ca 20-30 cm thick layers of fragments of decoloured mangrove and marine shells. The Daun sites did not yield either fish hooks or fish bones.

We have no proxies for fishing from the 5th millennium BP sites of Ras Gadani and Ras Phuuri (Biagi *et al.* 2013). A few net-sinkers notched from pebble come from the surface of 4 of the ca 70 Lake Siranda shell middens: SRN-29 (1 specimen from the southern part of the huge

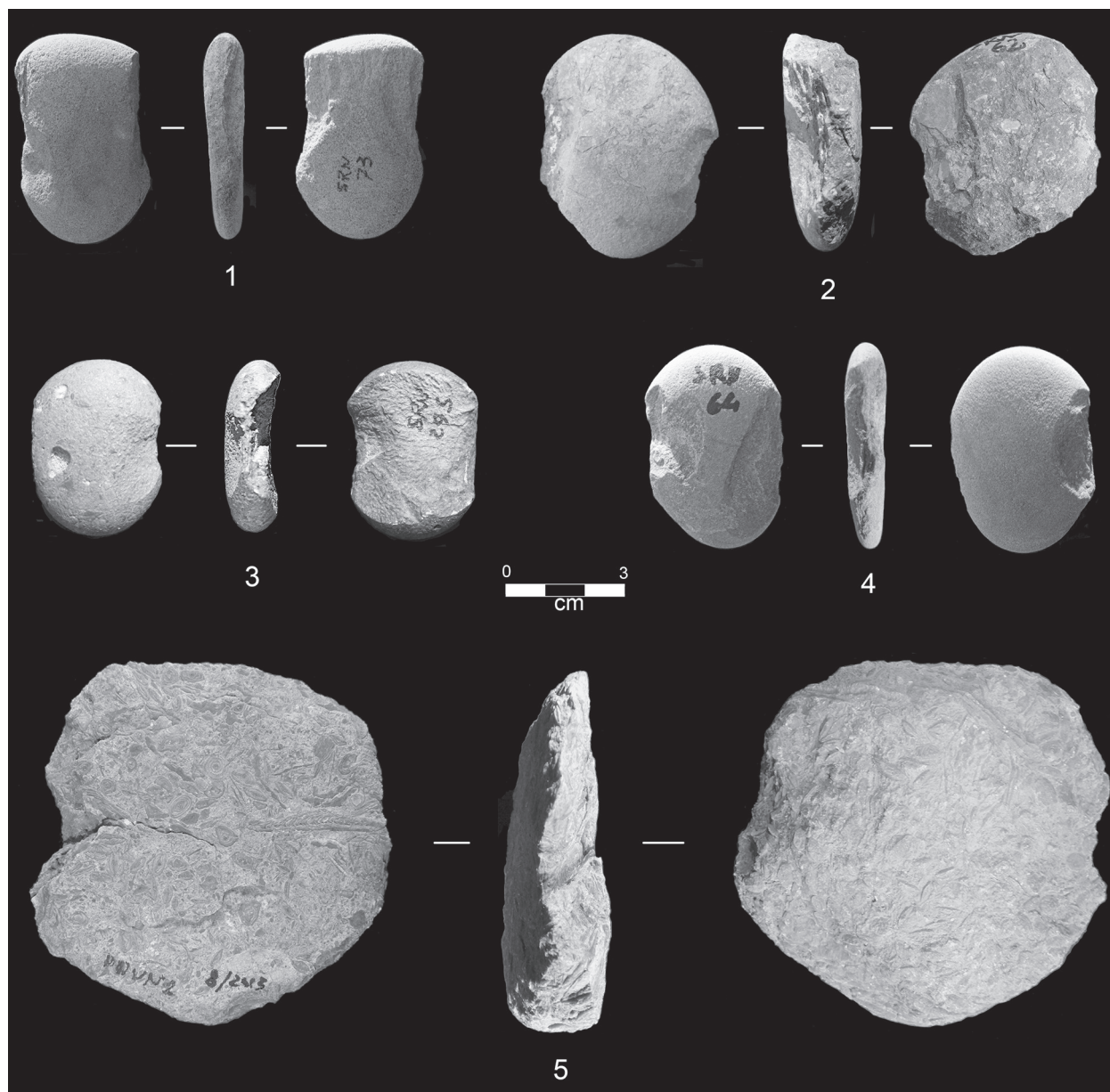


Figure 6. Stone net-sinkers from shell middens of Las Bela in Balochistan (Pakistan): Lake Siranda, SRN-73 (n. 1), SRN-62 (n. 2), SRN-29 (n. 3), SRN-64 (n. 4), and Daun-1 (n. 5) (photographs by E. Starnini).

shell mound), SRN-62, SRN-64, and SRN-73 (Figure 6, nn. 1-4). These sites have been radiocarbon dated by one single, adult specimen of *T. palustris* mangrove gastropod to the 7th millennium BP Neolithic period (SRN-29: GrA-54229: 6595±35 BP; SRN-64: GrA-57535: 6515±35 BP; SRN-62: GrA-59842: 6230±60 BP) and to the Chalcolithic (SRN-73: GrA-57705: 5695±35 BP). Evidence of fishing is represented also by a few otoliths collected from the surface of 6 different Siranda sites (Girod, pers. comm. 2018).

Fishing during Chalcolithic and Bronze Age Indus periods in Las Bela is confirmed by the large quantity of fish bones retrieved from Balakot, a multi-layered

mound located at the northern edge of the Kurkhara Plain (Meadow 1979; Belcher 1999). Their study suggests that nets were probably employed to capture most species (Belcher 1997). This opinion has been recently reinforced by the recovery of the remains of an exceptionally well-preserved carbonized net made from leaves fibres at Shahi Tump in the Kech Valley of Balochistan, ca 120 km from the coast of Makran (Thomas *et al.* 2012).

Our data regarding prehistoric fishing along the coast of Sindh, and the Indus delta in particular, are still very poor. Evidence for sea and mangrove shell gathering is known from almost all of the limestone terraces that

outcrop from the alluvial plain of the Indus fan (Blanford 1880). Their radiocarbon dating has dramatically improved our knowledge of the advance of the Indus delta between the Mesolithic and the Hellenistic periods (Biagi 2017, 2018). However, archaeological information regarding prehistoric fishing is at present missing.

The only prehistoric site from which we have evidence for fishing was discovered in the 1970s at Sonari by Professor A. R. Khan. The small fishermen settlement is located inside a wide saddle, close to the mouth of the Hab River, ca 7 km north-east of Cape Monze (Biagi and Nisbet 2014). From this region we have a good ethnographic data-set regarding different ways and complexity of year-round contemporary fishing procurement strategies (Belcher 1999: 29). The Sonari features consist of at least six small rectangular stone-walled rooms filled with marine bivalves of *Meretrix*. Three of them have been radiocarbon dated between the Chalcolithic and the beginning of the Bronze Age by single specimens of *Meretrix* shells (SNR-1C: GrA-63867: 5125±35 BP; SNR-1B: GrA-59837: 4850±60 BP; SNR-1A: GrA-59839: 4780±60 BP). The site did not yield any fish bone or fishhook. However, fishing is confirmed by the recovery of many bilaterally notched net-sinkers knapped from beach pebbles (Biagi *et al.* in press: Fig. 10 and 11).

The Sultanate of Oman

The Sea of Oman is considered to be one of the most productive in terms of marine resources, and wealth of fish (Al-Jufaili *et al.* 2010), with a great variety of species, both invertebrates (crustacea, echinoderms, and molluscs) and vertebrates (Desse-Berset and Desse 2005). Most fishes are available in proximity of the shoreline, and can be easily caught by simple techniques (Lancaster and Lancaster 1992). Moreover, various species of molluscs live in different environments (rocky cliffs, sand shores, mangroves and estuarine) although nowadays this resource is less consumed.

The earliest archaeological traces of fishing are known from the cave of Natif 2 (HMB-10) in Dhofar, whose oldest occupation layer containing fish bones has been dated to 9330±50 BP (Poz-54319) (Charpentier *et al.* 2016: 350).

More data were retrieved from the coast of Oman during many years of intensive, systematic research aimed at the study of the prehistoric shell middens of south-eastern Arabia (Beech 2003; Uerpmann and Uerpmann 2003; Berger *et al.* 2005, 2013; Cleuziou 2005; Charpentier *et al.* 2016).

The first shell middens of the Oman Peninsula were discovered by chance on the cape of Ra's al-Hamrā, in

the Capital area, by R. Jäckli of Petroleum Development Oman (PDO) in 1970 (Tosi and Durante 1977; Biagi and Nisbet 1992; Marcucci *et al.* 2012: Fig. 1). The headland marks the southern end of the Batinah coast, a unique, highly productive marine ecosystem (Biagi *et al.* 1984: 47; Biagi and Nisbet 1999). Most of the Ra's al-Hamrā middens were located on the flat limestone terrace that elongates south of the mouth of Wadi Aday whose freshwater supply favoured the formation of the national reserve of Qurum mangrove swamp (Uerpmann and Uerpmann 2003). The only exception is RH-6, a site located on a lower terrace, very close to the right bank of the wadi course (Biagi 1999). Most of the shell middens were destroyed in the 1970s because of increasing building activity. Only a few were partly excavated (RH3, RH-4, RH-5, RH-6, RH7 and RH-10) or preserved for future research (RH-6).

The information gathered thanks to many years of excavations constitutes the backbone of the chronology of the Holocene peopling of the northern coast of Oman, during which shell middens started to be settled and developed. Their chronology was built almost exclusively on the radiocarbon results obtained from the two subsequent sequences of RH-6 and RH-5. They span ca 1000 years each from the middle of the 7th to the second half of the 5th millennium BP (RH6, from 6530±60 BP: Bln-3637/II to 5750±60 BP: Bln-3636/I; RH-5, from 5395±85 BP: Hv-10925 to 4730±60 BP: Bln-3135: Biagi 1994). However, a few more recent dates were obtained from the sites of RH-3, RH-4 and RH-10 (Biagi *et al.* 1984: 57).

The importance of fish in the diet of the RH-5 inhabitants has emerged from the study of the faunal remains that shows that fish represents 80% of the total assemblage (Uerpmann and Uerpmann 2003: 178). From the study of the fish bones, Uerpmann and Uerpmann (2003: 180) conclude that fishing of small species like sardines was only one of the strategies followed by the inhabitants of RH-5, whose marine subsistence economy relied mainly on large fishes. This shows that fishing was rather specialised (Uerpmann and Uerpmann 2003: 182). Although the two authors noticed some differences comparing the ichthyofaunal composition of the Omani shell middens, they observed a general pattern of pronounced scombrid/carangid dominance, which, in their opinion, reinforces the evidence of a specialised fishing strategy (Uerpmann and Uerpmann 2003: 193).

Many shell middens of the coast of Oman are multi-stratified settlements that were repeatedly inhabited throughout a long period sometimes spanning ca 1000 years. Their sequences consist of overimposed and intercalated layers of marine and mangrove shells (*Terebralia palustris*), fish, green turtle and domestic mammal bones, ash, charcoal and wind-blown sand (Biagi and Nisbet 1999: 46). They often yielded evidence



Figure 7. RH6 (Muscat, Oman): Fish bones (top) and shellfish, charcoal and bone samples from the flotation of one sample from the 1986 excavations (bottom) (photographs by P. Biagi, January 1986).

of different types of semi-circular or circular dwelling structures (Cavulli 2004; Marcucci *et al.* 2011), postholes, rubbish pits, hearths and fireplaces (Biagi and Nisbet 1999: 41; 2006, Figure 5), primary and secondary graves or graveyards (Santini 1987; Salvatori 2007; Munoz 2008).

Besides the impressive amount of shellfishes and fish bones yielded by the shell middens of the Capital area (see e.g. Biagi and Travers 1985; Uerpmann and Uerpmann 2003) (Figure 7), other archaeological

indicators of fishing are present within the material culture assemblages. They consist of fish hooks, net-sinkers and other fishing gears (Uerpmann and Uerpmann 1996: 134; Beech 2003). At least four middens yielded evidence of local shell fish hooks manufacture (Biagi 1999; Uerpmann and Uerpmann 2003; Cavulli *et al.* 2009) or production of different types of net-sinkers (Cavulli and Scaruffi 2011). This is the case for RH-6 in the Qurum swamp, KHB-1 at Ra's al-Khabbah, Khor Milkh, south of Quriyat, and HD-6 at Ra's al Hadd (Bavutti *et al.* 2015).

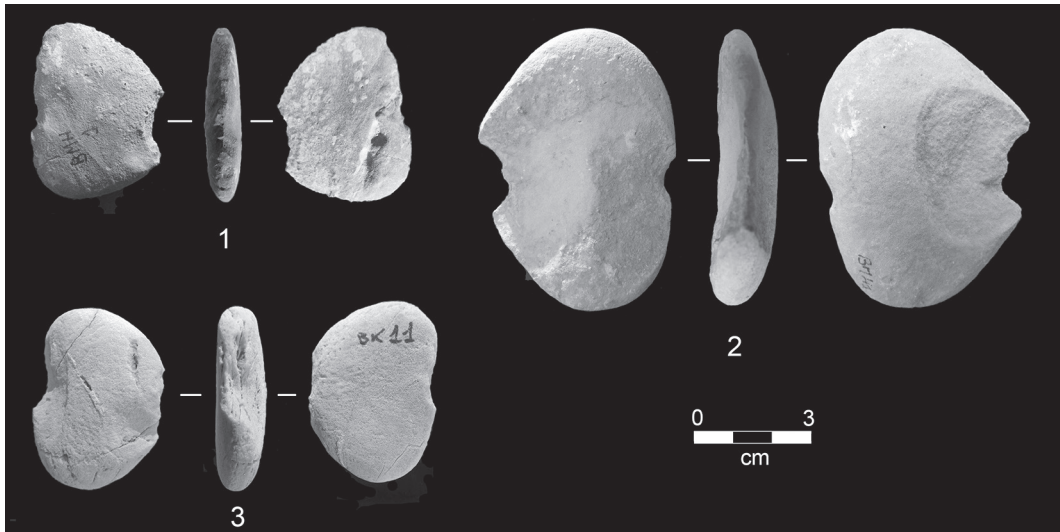


Figure 8. Stone net-sinkers from the shell middens of Bimmah (nn. 1 and 2) and Bandar Khayran (n. 3) (Oman) (photographs by E. Starnini).

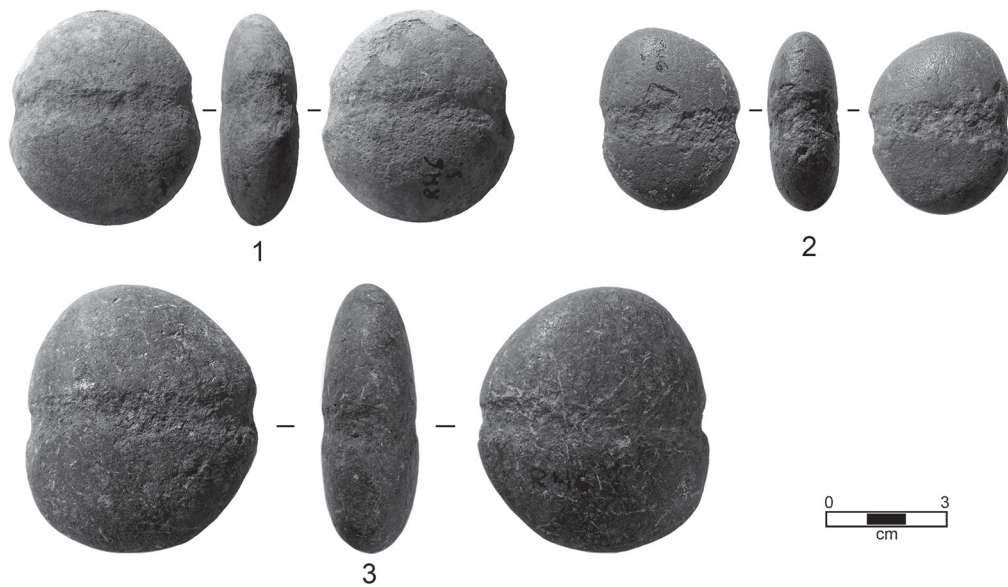


Figure 9. RH-6 (Muscat, Oman): Stone net-sinkers from the surface of the site (photographs by E. Starnini).

Net-sinkers or net-weights made from wadi or beach pebbles of flat oval to spherical shape, are characterized by pecked or sawn notches or a perimetral engraved or saw-in line (Vogt 1994: 124, Fig. 9.5, nn 8-11). They have been found in large numbers in some middens of the Oman coast (Figures 8 and 9), together with other stone tools among which are different types of hammerstones, crushing stones and anvils. The net-sinkers vary in size, shape, type, weight, and technology of manufacture. These characteristics are probable proxies of different chronologies, fishing techniques, functionality and/or cultural tradition that together with the variability of

fish hooks remarks ‘the complexity and versatility of fishing people’ (Salls 1989: 195). It is important to remark that very small saw-in and grooved net-sinkers on spherical pebbles are common from the lowermost part of the mid 7th millennium BP RH-6 sequence (Biagi 1999: Fig. 14, nn. 1-7), while they are absent from the 6th-5th millennium BP sites of RH-5 and KHB-1.

According to our present knowledge based on the studied faunal datasets, the practice of fishing of mainly small-sized species in the shallow coastal waters of Dhofar started to be practised during the second half



Figure 10. GAS-1 (Ash Shab, Oman): The prehistoric site from the south with the location of the two radiocarbon dated samples from soil (GX-17881: n. 1) and from shell hook (GrA-63871: n. 2) in the right, upper corner (photograph by P. Biagi, January 1992).

of the 9th millennium. The situation changed since the 7th millennium BP when most of the shell middens of the south-eastern Arabian coastline were settled, larger and pelagic fishes make their appearance in the faunal assemblages, together with innovative fishing strategies as is shown by different types of fishing gears. Specialised fishing seems to have been practised since the following millennium (Charpentier *et al.* 2016).

Evidence from RH-6 shows that fish hooks made from *Pinctada radiata* marine shell were produced locally during the first two centuries of the 6th millennium BP. This is marked by 5 coherent radiocarbon assays obtained from *Avicennia marina* charcoal, marine and mangrove shells sampled from layer 2 of the uppermost trench opened at the site (from 5980±60 BP: Bln-3641/I to 5830±80 BP: Bln-3640/I) (Biagi 1999: 41). A comparable date is available also for the Akab Island in the Arabo/Persian Gulf (PA-2356: 5900±50 BP) (Méry *et al.* 2008: 17). One fragment of shell hook from the surface of site GAS-1 at Ash Shab (Gaultier *et al.* 2005) (Figure 10) yielded a more recent radiocarbon date (GrA-63871: 5170±35 BP) that coincides with that obtained from a sample of organogenic deposit from the same site (GX-17881: 5127±80 BP) (Biagi 2004: Fig.

10). Similar radiocarbon dates from shells are available also from the site of Khor Milkh (from 5385±95 BP: Hv-15743 to 5165±95 BP: Hv-15742) (Uerpmann and Uerpmann 2003: 101). The aforementioned series of dates demonstrates that medium and large shell hooks were produced and utilised in Oman throughout the entire 6th millennium BP, while undated evidence suggests that their manufacture continued also in the following millennium (Bavutti *et al.* 2015).

Discussion

The information available for the region discussed in the present paper is based mostly on the pioneering study by Uerpmann and Uerpmann in the Sultanate of Oman and in particular the data provided by the fish remains from Ra's al-Hamrā and Khor Milkh (Uerpmann and Uerpmann 2003: 198-199). According to these authors the archaeological data available for the shell middens of the north-eastern coast of Oman, and in particular from fishing gears and fish bones, suggest that communities of specialised fishers settled at least already from the 7th millennium BP. These communities relied mainly on the fishing of large species, probably employing some sort of boats, dugouts



Figure 11. Ra's Sharbitat (Dhofar): Groups of cubic fish storage stone structures (top), and characteristic stone fishermen house (bottom) (photographs by P. Biagi, April 1986).

or floats, and in a few cases also on opportunistic marine mammals catch (Charpentier 2018). However, the presence of marine species from different habitats and environments indicates complementary activities among which are fishing in shallow waters or lagoons with the aid of traps, hand-lines and casting nets along cliffs and shores (see e.g. Nadjmabadi 1992: 332).

Ethnographic studies on traditional fishing methods in Oman show that fishermen exploit creeks and lagoons only for family use in bad weather to avoid resource overexploitation, since these environments are spawning grounds (Lancaster and Lancaster 1992: 349). Therefore, the exploitation of multiple resources in different ecological environments might have been an

effective successful subsistence strategy for the human groups settled along the coasts of the Arabian Sea since prehistoric times. Moreover, small fish species, especially sardines, have always been an important resource in the arid environments of Oman because pounded dried sardines are a feed for goats and cows and soil fertilizer (Lancaster and Lancaster 1992: 351; ElMahi 2000). This practise has a long tradition since it is reported also by the 14th century AD Arab traveller Ibn Battûta (Battûta 1958).

Changes in subsistence strategies, social organization and resource exploitation might be inferred by the appearance of copper and bronze fish hooks of different size from the 5th millennium BP (Méry and Marquis

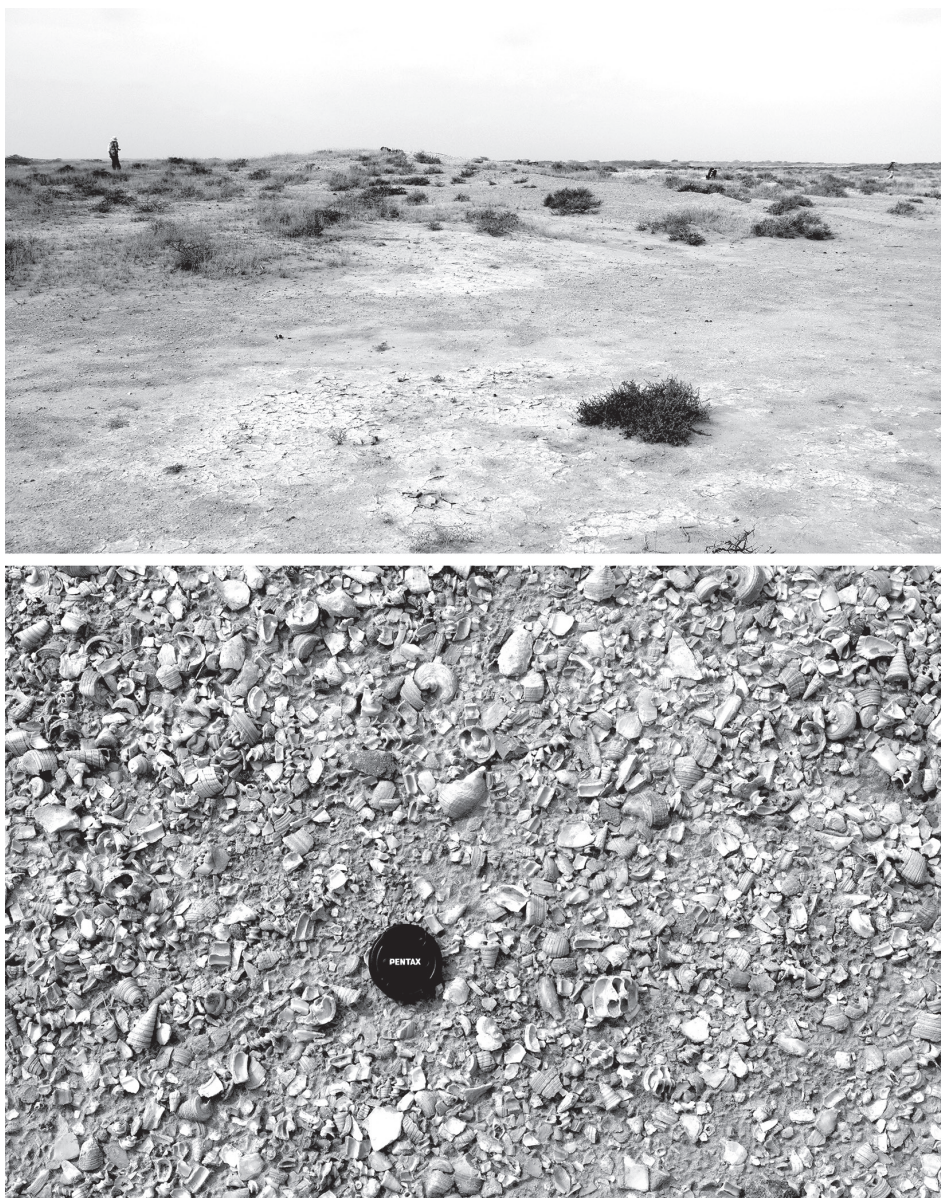


Figure 12. SRN-29 (Lake Siranda, Las Bela): The shell mound from the south-east (top) and broken mangrove shells on its surface (bottom) (photographs by P. Biagi, January 2012).

1998; Cleuziou and Tosi 2000; Charpentier 2002; Beech 2003: 293) to at least the middle of the 4th millennium BP, as confirmed by a radiocarbon date from charcoal from room 5/2 excavated at Ra's al Junayz (RJ-1) (Bln-3689: 3450±70 BP; Biagi *et al.* 1989: 18).

Apart from the circular dwelling structures discovered at the aceramic coastal middens, the Sultanate of Oman offers a few evidences of Bronze Age, squared stone-walled structures, one of which, excavated at Suwayh (SWY-3), was dated to 4325±40 BP (Pa-1674) by a sample of marine shells. Part of the structure was built 'on top of a shell layer of *A. umbonella*' (Méry and Marquis 1998: 219). This practise recalls that observed at the sub-recent, deserted fishermen village of Sharbitat in

Dhofar, where all stone houses were erected on a thin pavement of accurately selected colourful, tiny marine shells (Figure 11, bottom).

Groups of rectangular stone wall structures paved or covered with marine bivalves have been discovered also at Sonari in Sindh, radiocarbon dated between the end of the 6th and the first centuries of the 5th millennium BP from *Meretrix* marine shells. They represent the only archaeological indicator of a Bronze Age fishermen and mollusc gatherers village so far discovered all along the northern coast of the Arabia Sea.

The research carried out since the beginning of the 2000s along the coast of Las Bela yielded evidence of

Mid Holocene shell middens also in this territory. All these seasonal sites started to flourish in very similar environmental conditions, close to the shores of shallow lagoons and mangrove swamps, during the last centuries of the 8th millennium BP along both coasts of the Arabian Sea (see e.g. Snead 1966; Sanlaville *et al.* 1991; Berger *et al.* 2013). This observation is confirmed by a radiocarbon date from *T. palustris* obtained from site SRN-43 along the eastern edge of Lake Siranda in Las Bela province of Balochistan (GrA-54290: 7200±35 BP; Biagi 2013), and from the shell midden of SWY-11 at Suwayh, along the eastern coast of the Oman Peninsula (Pa-1716: 7275±60 BP; Lézine *et al.* 2002: 222).

As previously reported (Biagi 2011), there are striking differences between the shell middens of the eastern periphery of the Arabian Peninsula and those of Las Bela. The latter consist of ca 20-30 cm thick layers of mangrove and marine shells that might indicate episodes of exploitation of the local resources. None of these sites has ever been excavated. From their surface the presence of either structural remains or fireplaces has never been noticed. So far the only exception is the impressive shell mound of SRN-29, discovered along the eastern shore of Lake Siranda that is surrounded by small heaps of shells and other middens (Figure 12). This complex arrangement might indicate that SRN-29 acted as central place, was resettled many times, and that different activities were practised in its immediate surroundings.

Moreover, some of the Las Bela middens, Daun-10 for example, consist of scatters of very small fragments of mangrove shells suggesting that some kind of specialised activity took place at the site, perhaps connected with the liming of nets (Minchin 1983: 97). This minute fragmentation has never been recorded from any shell midden of the Oman Peninsula. Other points to be remarked regard the apparent absence of fish bones, and the very poor occurrence of fishing indicators, namely net-sinkers and a few otoliths of two species of large oceanic fishes (*Protonibea diacanthus* and *Arius tenuispinis*: Girod, pers. comm. 2018). Striking differences between the characteristics of the shell middens from the two opposed coastlines are marked also by different types of material culture remains. While the Las Bela middens yielded poor knapped stone assemblages characterised by a narrow bladelet technology and geometric microliths, these tools are not represented in the Omani shell middens whose lithic inventory consists of so-called 'unconventional' tools mostly obtained by hammering, anvil technique (Uerpmann 1992; Hilbert and Azzarà 2012).

This paper summarizes the data at our disposal regarding the peopling of the two coasts of the Arabian Sea between the end of the 8th millennium BP and the Bronze Age, when a complex urban civilization made its

appearance in the region.¹ This overview discusses the problems regarding fishing during aceramic Neolithic and Bronze Age raised during almost fifty years of research, many of which are still partly unsolved.²

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¹ Throughout the text all dates are presented in radiocarbon years uncal. BP given the well-known problems regarding the different calibration methods and variable reservoir age of marine and mangrove shell samples from different species, age, and Gulf regions from where they have been collected (see e.g. Uerpmann 1991; Biagi 1994; Biagi *et al.* 2012; Zazzo *et al.* 2012, 2013, 2016).

² Both Authors have been Members of the Italian Archaeological Expedition to Oman (P.B.: 1984-1992, and Director of the same Mission in 1990-1991; E.S. Member of the French-Italian and British teams of the 'Joint Hadd Project': 1986-1992 and 2003) and Sindh, Pakistan (P.B.: Director of the Mission in 1993-present; E.S. Member of the Mission in 1993-1998). The archaeological research in Oman was shared for some years with our friend Sandro to whom and his invaluable archaeological work in the region is dedicated this paper.

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