NEW RADIOCARBON DATES FOR THE PREHISTORY OF THE ARABIAN SEA COASTS OF LOWER SINDH AND LAS BELA IN BALOCHISTAN (PAKISTAN)

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Abstract
This paper presents new radiocarbon dates obtained from coastal sites in Lower Sindh and Las Bela in Balochistan. Samples of marine and mangrove shells have been radiocarbon-dated from eleven sites, mainly shell-middens. Since Terebralia palustris represents the commonest material employed for dating, the results are important also for the definition of the chronology of ancient mangrove swamps, which have left no other visible trace on the present landscape. Among the sites, which have been radiocarbon-dated, are those of the Tharro Hills near Gujo, which yielded characteristic Amri assemblages, and Pir Shah Jurbo, most probably a port close to the mouth of the Hub River, which has been attributed to the Mature Harappan Civilisation.

1. PREFACE
During the last ten years the absolute chronology of the prehistoric and historic settlement of Sindh and Balochistan has greatly improved thanks to a systematic programme of dating. The sites which have been radiocarbon-dated are distributed over a territory between Sukkur and Rohri in Upper Sindh, to the north, and the coasts of Lower Sindh and Las Bela, to the south. Until the end of the last century, the number of radiocarbon dates available for Upper and Lower Sindh was restricted to those obtained from the Harappan and Amri phase settlements of Mohenjo-daro (KAKKAR, 1991), Kot Diji (KHAN, 2002: 63) and Amri (CAIL, 1964).

During a project of surveys and excavations carried out between 1993 and 2001, named "Joint Rohri Hills Project", a few more sites of Upper Sindh were sampled for dating. They are: Lakhwarna, in the suburbs of Sukkur, along the right bank of the Indus (KAKKAR, 1989; BACI, 2000: 90); (Fig. 1.1); Rohri Hills Quarry-Pit 652 (BACI, 1995: 81) (Fig. 1.3); Aror, the ancient capital of Sindh (BOSNARI, 1991; OTTOVAND and BACI, 1987: 78) (Fig. 1.2); and the Buddhist town of Seeraj-i-Takri (BACI et al., 2002: 18) (Fig. 1.4). The two latter sites are located along the northern (Aror) and central-western fringes (Seeraj) of the Rohri Hills. The first two belong to the Mature Harappan Civilisation, the others to the Medieval Period. The new radiocarbon dates are listed in Table 1.

Since the beginning of the century, surveys have been carried out along the coasts of Lower Sindh and Las Bela (Balochistan). They led to the discovery of a few shell-middens. Some other already-known sites were also revisited, with the aim of collecting organic samples for radiocarbon dating.

The region in which the research has been carried out extends from the city of Thatta, in the east, to Gadani Promontory, in the west. Furthermore, an area of the Arabian Sea coast between the headland of Gadani and Cape Monze (RAS MUHARI), as well as the settlement of Tharro Hills (COSSING, 1929: 46; MAHMOOD, 1934: 20) located near the present village of Gujo, have been surveyed several times.

2. THE ARCHAEOLOGICAL SITES AND THEIR RADIOCARBON CHRONOLOGY
2.1. The sites of Lower Sindh
The sites of Lower Sindh which have been sampled during the last four years for radiocarbon dating are, from east to west: those of Tharro Hills near Gujo (KAKKAR, 1991: 5); Multan Hills 18 (MH18), south of Karachi University Campus (BACI, 2004); Pir Shah Jurbo, along the left bank of the Hub River (KAKKAR, 1997: 3); and Soneri, on a high terrace close to the mouth of the same watercourse.
most point of the C-shaped enclosure of the eastern terrace. On its surface a few specimens of *Teretria pulicris* mangrove shells were also observed. The sample of oyster shells yielded a result of 5240±40 u.c. BP (GRN-27053), which perfectly fits into the time-span to be expected for an Amri Culture settlement (Khan, 1979b: 21).

### 2.1.2. Mulri Hills IB (M118) (24°54'45" Lat N - 67°06'30" Long E)

The Mulri Hills are located just south of Karachi University Campus (fig. 2.2; map, II.4). They are composed of variiegated sands which are covered with a clayey deposit of red soil. About 2 m above sea level, they were usually covered with a layer of salt. It was later eroded away and is now preserved only in a few pockets along the fringes of the hills. According to the field notes of Prof. A.R. Khan (pseud. comm. 2002), most of the Mesolithic sites were located along the faults which cross the hills, often close to freshwater springs.

At present, Mulri Hills IB (M118) is the only radiocarbon-dated site of the hills. It is located along the southern upper ridge, close to the base of the slope of the hill. The area of radiocarbon artefacts amounts to 16 cm (5 subconical, 4 prismatic, 6 polyhedral and 1 terete-shaped), 20 tiny flints (11 curved, 6 backed blades and 2 wide lunates, 3 trapezes, 1 backed bladelet and truncation, 2 probable straight and 6 retouched bladelets and 90 fragments). One single piece of *Teretria pulicris* mangrove shell has been dated to 5780±70 u.c. BP (GRA-26369) (BAIG, 2004). The result is at least one millennium more recent than expected. Given the method employed for collecting the finds from the surface, it is impossible to establish whether the *Teretria pulicris* fragment used for dating is contemporary or not to the Mesolithic flint assemblage.

### 2.1.3. Pir Shah Juri

The site of Pir Shah Juri (fig. 2.3) "is located near the mouth of the Hab River and must have served as a port" (map, I.4). It lies "...on a conglomerate terrace, more than 50 feet above the sea-level, on the left bank of the Hab. The settlers reached beyond this point even at high tide. There are indications of some stone foundations covered with wind blown sand. The site is now occupied by a graveyard. The objects found at the site include much plain and red pottery, some decorated with designs in black, perforated pottery, broken frame and toy dice, stone blades and scrapers, one polished chert knife, clay and shell hangers, copper pieces, and triangular clay tablets" (Khan, 1979b: 3 and 4).

These assemblages, which are now in the collections of the Museum of Prehistory and Palaeo-geography of the Department of Geography, Karachi University, indicate that the site is to be attributed to the Mature Harappan Civilization. Apart from being a coastal Harappan settlement, and most probably a port, the site is important for yielding a very long retouched bladelet obtained from brownish variiegated (striped) flint (fig. 5), the geological outcrops of which are to be sought along the northern fringes of the Rohri Hills in Upper Sindh (BAIG, 1997: 29). This find demonstrates that, during the Bronze Age, Rohri Hills flint was undoubtedly traded southwards to Lower Sindh, as far as the coasts of the Arabian Sea.

The site was visited in January 2001, when a sample of *Teretria pulicris* mangrove shells was collected from a scatter of four square metres, along the northern slope of the mound. It has been dated to 4190±80 (uncal. BP = 3290±150). The result is some four to five centuries more recent than that expected for a Mature Harappan settlement.

### 2.1.4. Sonari (24°52'28" Lat N - 66°41'54" Long E)

The shell-midden of Sonari lies on a high terrace of the Upper Nari formation (Khan, 1979b: 49), just to the left of the Hab River mouth (fig. 2.4). Above the fishermen village of Sonari, the same name (map, II.3). Strangely his discoverer has never mentioned this site, even in his monograph on the prehistory of the region (Khan, 1979).

Sonari consists of a thin mound, some 20 m in diameter, at present partly covered by a Muslim cemetery. Five blatelittorally net-sinkers, obtained from beach pebbles (fig. 6, 6.10), a few chert implements on retouched bladelets (fig. 6, 6.4), a few Gadaani-type Jasper flakelets (see below), and one fragment of ostrich egg (fig. 6.5) were collected from its surface. The site did not yield any fish bone. In contrast, it is rich in *Teretria pulicris* mangrove shells, a sample of which was collected for radiocarbon dating. It yielded the result of 4080±30 u.c. BP (GRN-27054). The site is of extreme importance because it is the only shell-midden in the area from which both fishing (ferred from the fishing-related artefacts) and the collection of mangrove shells is reported.
The sites of Las Bela (Balochistan)

The Las Bela coastal sites sampled for radiocarbon dating are located around the small bay of Daun, on the top of the marine terrace a few kilometres to its south, and on the Gadani promontory. The sites of Daun were discovered between January 2000 and February 2004, while A.R. Khan (1979b: 12) was the first to point out the importance of the raw material sources of Gadani.

2.2. Daun

The area of Daun is very rich in prehistoric shell-middens. So far they have been discovered in two well-defined areas of this part of Las Bela coast: 1) on the top of the limestone Pleistocene marine terrace (Sohag, 1969) that faces the Arabian Sea to the west, and 2) around the Bay of Daun, a few kilometres north of the above-mentioned point (fig. 2, 5) (Biagi, 2004a).

The shell-middens of the first area were discovered in February 2004. A group of six shell-middens were recorded on the right side of the earth road that leads to the ocean. Their distribution is schematically shown in fig. 7, top. Four of these sites were sampled for radiocarbon dating. They are:

Daun 4 (24°59'18" Lat N - 66°42'30" Long E): it consists of a scatter of large-sized Ostreidae shells, groups of which were brought to the terrace attached to marine pebbles, and a small amount of Terabala palustris mangrove shells (tab. III, 1). The site yielded a few microflakelets of dark reddish-brown Gadani jasper and light grey flint. A sample of Ostreidae was dated to 4000±35 uncal BP (GN-28803).

Daun 5 (24°59'19" Lat N - 66°42'29" Long E): it is a scatter of Terabala palustris shells. This shell-midden is located very close to Daun 4. Around the major concentration of mangrove shells, which was sampled for radiocarbon dating (tab. IV, 2), a few circular stone structure were observed, one of which should indicate the presence of a burial, the others of circular fireplaces. Daun 5 produced a result of 3900±35 uncal BP (GN-28801).

Daun 6 (24°59'25" Lat N - 66°42'24" Long E): it is a small shell-midden, some 2.5 m in diameter, of small Macridinae marine bivalves (tab. III, 3). A sample of these shells was dated to 3370±35 uncal BP (GN-28802).

Daun 8 (24°59'26" Lat N - 66°42'33" Long E): it consists of a scatter, some 3 m in diameter, of fragments of Terabala palustris shells (tab. III, 4). A small lower quern with one oval cup-mark in its centre was found within the shell-midden. A sample of mangrove shells was radiocarbon-dated to 4540±55 uncal BP (GN-28803).

The second area is the Bay of Daun, where four sites (fig. 7, bottom) were discovered during the surveys carried out between January 2000 and February 2004. Two of these were sampled for radiocarbon dating:

Daun 1 (24°50'15" Lat N - 66°43'29" Long E): it is located along the slope at the south edge of the bay (tab. IV, 1). It consists of a heap of fragmented Terabala palustris shells, some 25 m long and at least 25 cm thick. Other marine shells were observed, among them specimens of Ostreidae and Anadara trapeziformis. The chipped stone artifacts recovered from the surface consist of a few subpyramidal and subconical cores of dark reddish-brown Gadani jasper (fig. 8, 1-4) and a few microflakelets of light grey flint. Concentrations of small, cup-marked lower querns were also observed (tab. IV, 2), as well as a few fragments of weathered, coarse pottery. A sample of Terabala palustris shells yielded a date of 6380±40 uncal BP (GN-26368).

Daun 3 (24°50'25" Lat N - 66°43'07" Long E): this shell-midden lies at the northern edge of the bay (tab. IV, 3). The upper part of the site looks like a wide, rounded heap of fragmented Terabala palustris shells, which were dated to 4100±30 uncal BP (GN-27945). The site elongates for some 40 m along the slope. It consists of a few concentrations...
of mangrove shells and, in its lowermost part, mainly Ostracidae. The chipped stone industry from this site includes a few Gadani jasper, and grey-bluish flint, microflakes and one abrupt-retouched broken blade of exceedingly provenance with a very pale brown patina (fig. 8, 6). Other stone artefacts are represented by lower querns with one oval cup-mark in their centre (tab. IV, 4).

2.2.2. Gadani (25°06' Lat N - 66°43' Long E)

As mentioned above, A.R. Khan (1979: 12) was the first to report the presence of a prehistoric site on Gadani headland (fig. 2, 6), some 20 miles north of Cape Monee (Ras Mubarak) (tab. II, 1). In his paper he points out the occurrence of a "...red variety..." of chert "...obtained from Path limestone at Gadani". In effect the entire promontory is very rich in a dark reddish brown variety of jasper, whose outcrops are visible from a long distance. The area is covered with scatters of jasper flakes (tab. II, 2), while no retouched tools have so far been found. Concentrations of animal bones and Terebra/ia palustris mangrove shells were also observed. A sample of this latter species has been collected for radiocarbon dating from a concentration of 1 square metre. The result obtained is 4460 ± 30 uncal BP (GrN-76369).

3. DISCUSSION

The radiocarbon results presented in this paper shed new light on the chronology of the prehistoric sites of the regions under study, from which no absolute date had ever been obtained before (Pearsall, 1988). The utilisation of samples or single specimens of Terebra/ia palustris shells for dating is of great importance. In effect, apart from dating the archaeological sites themselves, this species informs us of the presence of past mangrove swamps, which are at present totally absent from the area. The radiocarbon results show that prehistoric people exploited these environments...
fig. 8 - Daun 1: Jasper, subangular, bladelet core (1-4); Daun 10: flint prismatic, bladelet core (5); Daun 3: flint retouched blade (6) (drawn by P. Bagi and G. Alemquigan).

for several millennia, approximately from the middle of the fifth millennium cal BC to the beginning of the second millennium cal BC, as the results of the radiocarbon dates from Gadani, Daun, the Hub River sites and the Mulri Hills appear to indicate. Nevertheless there is little doubt that the correct calibration of both mangrove and marine shells are problematic. Daun, why a S of 248±24 years has been subtracted, following the indications of von Rans et al. (1999). The results of these calibrations are presented in Table 2, and in the scatterplot of fig. 9. They raise the following questions:

1) the results obtained from the Daun sites show that the shell-middens of this area are not all contemporaneous. The oldest date so far obtained is that of Daun 1. It is of particular importance, because it indicates that the exploitation of the coastal resources of Lat Bele began around the middle of the fifth millennium BC (uncal BP) (before the middle of the fifth millennium cal BC) (Gn-25638). This is not surprising since the same phenomenon is documented from the radiocarbon results of the oldest shell-middens excavated along the southern coast of the Arabian Sea in the Sultanate of Oman (Baig et al., 1994). For instance, the earliest occupation layers of the shell-midden of KI6, at Muscat, yielded very similar dates (Baig et al., 1999). The picture, which is now emerging, shows that the coast of the Arabian Sea began to be exploited by gatherers of marine and mangrove shells at least one millennium after the middle of the seventh millennium uncal BP.

2) the other Daun dates cover a time-span of less than two millennia, from the middle of the sixth millennium uncal BP (middle fourth millennium cal BC) (Gn-28810) to the end of the fifth millennium uncal BP (first centuries of the second millennium cal BC) (Gn-27945). Furthermore, three sites, which lie very close to each other on the same Pleistocene terrace, yielded similar results even though they were obtained from different shell species. This fact might suggest the exploitation of different coastal environments (Daun 5 (Gn-28801, Terebra paliopsis), Daun 4 (Gn-28800, Ostreidae) and Daun 8 (Gn-28883, Mactridae);

3) the flint assemblage from Daun 1 and Daun 10 (undated), consist of small subangular and prismatic microbladelet cores obtained from Gadani jasper or exogenous light grey bluish flint (fig. 8, 1-5); in contrast, the shell-midden Daun 3 yielded only one characteristic tool, more precisely a patinated, abrupt-retouched blade of exogenous flint, which can be typologically referred to the Bronze Age (fig. 8, 6). While the first two sites can most probably be attributed to a period of development near the beginning of the Neolithic (Gn-26368), which is so far totally unknown in the region, the third indicates a much later occupation (Gn-27945);

4) the presence of Neolithic (Daun 1: Gn-26368), Chalcolithic (Daun 6: Gn-26822) and more recent shell-middens, would suggest the existence of more permanent sites of these periods in the regions of the interior. In effect, A.R. Khan (1979a: 18) reports "... 60 miles inland and at an height of more than 1,000 feet, shells are found at a Chalcolithic site". Furthermore, the same author points out the presence of several sites with "...plain red pottery of Chalcolithic period" (Khan, 1979a: 8) or which are characterised by the "...thick shining plumed point of the time" (Khan, 1979a: 8).

5) the radiocarbon date obtained from the Amri site of Tharro Hills perfectly fits into the time-span of development of the Amri Culture (Chal, 1964). This is not the case for the Mesolithic site of Mulri Hills (Bci 18), the result from which is at least one millennium more recent than expected (Gn-26369). Also the date obtained from the Terebra paliopsis sample of the Mature Harappan site of Pir Shah Jurro is problematic, since it is some four-five centuries more recent than expected (Gn-26370). These two results should indicate that the exploitation of the mangrove resources, which were adjacent to the archaeological sites, continued after their major period of habitation. A similar observation can be put forward for the shell-midden site of Sonari (Gn-27954: 4081±30 uncal BP), the radiocarbon result from which is more recent than expected. Nevertheless it is important to point out that this shell-midden site is very different from those discovered along the coast of Daun. Sonari is the only site from which fishing activities are reflected by the occurrence of beach pebble net-sinkers. The presence of one fragment of ostrich egg is particularly important, since little is known of the prehistoric chronology and distribution of ostrich along the coasts in the Indian Subcontinent (Nimat, 1990).

6) the three more recent dates so far obtained from Pir Shah Jurro (Gn-26367: 4100±20 uncal BP), Daun 3 (Gn-27945: 4105±30 uncal BP) and Sonari (Gn-27954: 4081±30 uncal BP), all from Terebra paliopsis shells, are almost identical. Even though they might not reflect the correct chronology of some of the sites from which they have been collected (see above, point 5), nevertheless they demonstrate that the lower Hub River course and the Bay of Daun were still characterised by mangrove swamp environments around the beginning of the second millennium cal BC.

7) the radiocarbon dates obtained from Gadani should indicate that the dark red jasper outcrops of this headland were exploited during the development of the (Mature) Harappan Civilization (Gn-26369: 4462±30 uncal BP). Nevertheless, the finds from both Daun I and the Mulri Hills (Karachi) show that this variety of jasper was undoubtedly employed for chipping artefacts at least from the beginning of the late Mesolithic period, if not before. The question to be solved is whether the Mesolithic and Neolithic people that inhabited the area
during this period exploited jasper from the Cretaceous Parah limestone of this premonitory, or collected rounded fluvial jasper pebbles from Khakhtar Kaur or other watercourses which flow from the north (Khan, 1979: 69).

Accordingly, this paper also revisits the question of the correctness of the calibration of the marine and mangrove shell samples, which, in this case, has been possible, in the way it is presented here, thanks to the value for $\Delta R$ recently proposed by von Raab et al. (1999).

Acknowledgments
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<th>Site Name</th>
<th>Lab. Number</th>
<th>Material</th>
<th>Date BP</th>
<th>Calibrated Date BC/AD (1 sigma)</th>
<th>Calibrated Date BC/AD (2 sigmas)</th>
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<td>Lakhwai-jo-daro</td>
<td>GtN-23123</td>
<td>Charcoal</td>
<td>3960 ± 140</td>
<td>2850-2800 (1.3%), 2700-2200 (66.7%)</td>
<td>2500-2000 (95.4%)</td>
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<td>RH 862</td>
<td>GtA-3233</td>
<td>Ziziphus charcoal</td>
<td>3870 ± 70</td>
<td>2660-2290 (60.8%), 2250-2230 (5.1%), 2220-2200 (2.3%)</td>
<td>2560-2020 (1.9%), 2500-2130 (93.6%)</td>
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<td>GtN-26401</td>
<td>Acacia charcoal</td>
<td>1270 ± 20</td>
<td>690-705 (11.4%), 710-730 (21.0%), 760-775 (16.0%)</td>
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<td>Charcoal</td>
<td>1080 ± 40</td>
<td>890-920 (21.3%), 930-1020 (46.7%)</td>
<td>890-1030 (95.4%)</td>
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Table 1 - List of the new radiocarbon dates obtained from the sites of Upper Sindh.

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<tr>
<th>Site Name</th>
<th>Lab. Number</th>
<th>Material</th>
<th>Date BP</th>
<th>Calibrated Date Range (1 sigma)</th>
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<td>Daum 1</td>
<td>GtN-26368</td>
<td><em>Terebralia palustris</em></td>
<td>6380 ± 40</td>
<td>4660-4540 cal BC</td>
<td>4720-4480 cal BC</td>
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<td>Malri Hills 18</td>
<td>GtA-25639</td>
<td><em>Terebralia palustris</em></td>
<td>5790 ± 70</td>
<td>4040-3910 cal BC</td>
<td>4160-3750 cal BC</td>
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<td>Daum 6</td>
<td>GtN-28802</td>
<td><em>Terebralia palustris</em></td>
<td>5370 ± 35</td>
<td>3610-3490 cal BC</td>
<td>3650-3540 cal BC</td>
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<td>Tharro Hills</td>
<td>GtN-27053</td>
<td>Ostreaeidae</td>
<td>5240 ± 40</td>
<td>3480-3330 cal BC</td>
<td>3510-3300 cal BC</td>
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<tr>
<td>Daum 5</td>
<td>GtN-28801</td>
<td><em>Terebralia palustris</em></td>
<td>4900 ± 35</td>
<td>2920-2870 cal BC</td>
<td>3020-2850 cal BC</td>
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<tr>
<td>Daum 8</td>
<td>GtN-28003</td>
<td>Ostreaeidae</td>
<td>4800 ± 35</td>
<td>2870-2750 cal BC</td>
<td>2980-2670 cal BC</td>
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<td>Gudari</td>
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<td>4080 ± 30</td>
<td>1880-1760 cal BC</td>
<td>1930-1720 cal BC</td>
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Table 2 - List of the new radiocarbon dates obtained from the sites of Lower Sindh and Las Bela in Balochistan. Calibration by the maximum intercept method (Grauert and Rimmer, 1986) using the Marine98 calibration curve (Grauert et al., 1998), AR = 248±24 (von Rad et al., 1999), and the program OxCal 3.5 (Bronk Ramsey, 1995; 1998).

Tharro Hills, semi-circular, western stonewall (1), stone, small mounds (2), potsherds from surface (3), Pll Shah Jurio from the south (4) (photograph by P. Bago).