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A radiocarbon chronology for the aceramic shell-middens of coastal Oman

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Our knowledge of the prehistory of coastal Oman has greatly increased during the last ten years. This article considers the radiocarbon chronology of the aceramic shell-middens scattered along the coast between Muscat, to the north, and Shuwayr, to the south. The appearance of these middens seems to correspond to the climatic deterioration that, according to more recent results, took place around the middle of the seventh millennium BP. The number of sites seems to have increased since the beginning of the actual arid phase, around 6000 BP.

Preface

Until 1977 no radiocarbon dates were available for the coastal Omani shell-middens. The first set of dates was obtained from a few charcoal samples collected from the surface and during rescue excavation at two sites on the cape of Ra's al-Hamra, west of the Capital, Muscat (1). During the 1980's the 14C dates were mainly obtained from samples collected during the excavations carried out at RH5, RH6 and RH10 (2), as well as from several sites discovered along the coast between Ra's Suwadi, to the north, and the Dhofar border (3).

14C chronology of the shell-middens of Ra's al-Hamra

On the Cape of Ra's al-Hamra (Fig. 1), only three sites have been accurately investigated, namely RH5, RH6 and RH10. RH5 was excavated between 1980 and 1985. Its stratigraphy, some 1 metre thick, has been interpreted with seven main phases of occupation (4). The uppermost layer 0, partly eroded by natural agents, gave only a few rubbish pits. One of these, Pit HWE/B, yielded many sherds of one black burnished pot (5). This phase has been dated to 4760±100 BP: 3670 (3542) 3390 cal BC (Bln-3140) and to 4949±60 BP: 3794 (3717) 3679 cal BC (Bln-3401) (6). The dating of the first occupation has been obtained from charcoal of *Avicennia marina* from a fireplace dug into the rubified bedrock discovered in the south-eastern corner of the site: 5510±60 BP: 4406 (4360) 4338 cal BC (Bln-3149).

A graveyard of 220 individuals dated between 4920±60 BP: 3785 (3706) 3659 cal BC (Bln-3156) and 4740±60 BP: 3633 (3522) 3387 cal BC (Bln-2737), was uncovered in the north-eastern part of the midden (7) (Table 1).

On the same cape, a few metres to the north-west of RH5 lay the site of RH10. According to the excavators, it was inhabited in two different periods dated to the first half of the seventh millennium and to the fourth millennium BP, while a cemetery with 26 burials should be attributed to *ca.* 5000 BP (8) (Table 2).

Extremely important results were produced from the excavation of RH6, on the right bank of Wadi Aday in the Qurm National Reserve

Table 1

Site	Layer	Feature	Lab n°	BP date	cal BC date (1 σ)	δ 13C	Material	References
RH5	0	Pit HXF	Bln-3140	4760±100	3670 (3542) 3390	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	0	Pit HXP-B	Bln-3401	4940±60	3794 (3717) 3679	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	1	Hearth HOH-D	Bln-3153	4730±60	3628 (3518) 3383	unknown	mainly *Avicennia marina*	Salvatori *pers. comm.* 1991
RH5	1	Hearth HOH-D	Bln-3153A	4770±60	3646 (3617, 3581, 3537) 3507	unknown	mainly *Avicennia marina*	Salvatori *pers. comm.* 1991
RH5	1	Pit HWT-CD	Bln-3168	4840±60	3699 (3648) 3541	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	1	Sq. HWJ-AB	Bln-3143	4880±60	3719 (3684) 3638	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	1	Pit HWN-D	Bln-3144	4900±50	3772 (3697) 3650	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	1	Pit HWM-D	Bln-3141	5030±60	3954 (3805) 3778	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	2	Sq. HWO-AB	Bln-3403	4820±60	3690 (3639) 3528	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	2	Hearth HOF-D	Bln-3154	4870±60	3713 (3672) 3633	unknown	mainly *Avicennia marina*	Salvatori *pers. comm.* 1991
RH5	2	Pit HXS	Bln-3148	4990±50	3918 (3788) 3714	unknown	mainly *Avicennia marina*	Salvatori *pers. comm.* 1991
RH5	3	Sq. HXG-AB	Bln-3145	4750±60	3637 (3526) 3391	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	3	Pit HXP-C	Bln-3402	4900±60	3776 (3697) 3646	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	3	Heart HOF-BC	Bln-3155	4910±50	3777 (3701) 3659	unknown	mainly *Avicennia marina*	Salvatori *pers. comm.* 1991
RH5	3a	Sq. HXG-AB	Bln-3146	4800±60	3667 (3631) 3520	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	3b	Sq. HXG-CD	Bln-3147	4920±60	3785 (3706) 3659	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	3d	Hearth HWI	Hv-13198	4768±70	3675 (3550) 3426	−20.8	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	3d	Sq. HWT-AB	Bln-3398	5070±50	3968, (3939, 3858, 3828) 3800	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	4	Sq. HWO-AB	Bln-3399	5130±60	4000 (3972) 3827	unknown	mainly *Avicennia marina*	Unpublished
RH5	4	Sq. HXQ-CD	OxA-2931	5160±90	4041 (3988) 3862	−26.9	*Setaria sp.*	Biagi & Nisbet in press
RH5	4	Sq. HWJ-BC	Bln-3394/I	5090±60	4001 (3984) 3964	+1.6	*Anadara uropigimelana*	Isetti & Biagi 1989: 6
RH5	4	Sq. HWJ-BC	Bln-3394/II	5200±50				
RH5	4	Sq. HWJ-BC	Bln-3393/I	5190±60	4028 (4001) 3983	unknown	*Terebralia palustris*	Isetti & Biagi 1989: 6
RH5	4	Sq. HWJ-BC	Bln-3393/II	5200±50				
RH5	5	Hearth HXQ-B	Bln-3400	5090±60	3982 (3952) 3804	unknown	*Avicennia marina*	Biagi & Nisbet in press
RH5	5a	Sq. HWO-AB	Bln-3404	4990±50	3918 (3788) 3714	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	5a	Pit HWO	Bln-3406	5050±50	3963 (3924, 3875, 3815) 3787	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	5a	Hearth HXQ	Bln-3405	5110±60	3992 (3962) 3814	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	5b	Sq. HXL-BC	Bln-3407	4860±50	3704 (3663) 3633	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 6
RH5	5b	Hearth 2	Bln-3149	5480±60	4371 (4350) 4321	unknown	mainly *Avicennia marina*	Isetti & Biagi 1989: 5
RH5	3d?	Fishpit 12	Hv-13193	5120±95	4011 (3969) 3826	−23.8	Ashy sediments	Uerpmann n.d.
RH5	3d?	Fishpit 16	Hv-13194	5181±75	4050 (4002) 3959	−23.8	Ashy sediments	Uerpmann n.d.
RH5		Sq. HEV-B	Bln-2736	4650±50	3506 (3378) 3358	unknown	Charcoal	Salvatori *pers. comm.* 1991
RH5		Hearth HPF-CD	Bln-3152	4900±60	3776 (3697) 3646	unknown	Charcoal	Salvatori *pers. comm.* 1991
RH5		Sq. KDS-AD	Bln-2735	5010±80	3951 (3807) 3702	unknown	Charcoal	Salvatori *pers. comm.* 1991
RH5		Sq. HON-C	Hv-10925	5395±85	4344 (4253) 4166	−16.2	Ashy sediments	Salvatori *pers. comm.* 1991
RH5*	Top	Sq. HJP	Bln-3397	5900±70	4877 (4802) 4734	unknown	Fish bones and ashy sediments	Unpublished

RH5*	Middle	Sq. HJP	Bln-3395	6060±60	5068 (4961) 4910	unknown	Ashy sediments	Unpublished
RH5*	Bottom	Sq. HJP	Bln-3396	6080±60	5133 (5006) 4925	unknown	Fish bones	Unpublished
RH5		Grave 21	Bln-2737	4740±60	3633 (3522) 3387	unknown	Charcoal	Isetti & Biagi 1989: 5
RH5		Grave 60	Bln-3150	4750±60	3637 (3526) 3391	unknown	Charcoal	Salvatori *pers. comm.* 1991
RH5		Grave 84	Bln-3151	4760±60	3641 (3612, 3588, 3531) 3405	unknown	Charcoal	Salvatori *pers. comm.* 1991
RH5		Grave 69	Bln-3157	4840±60	3699 (3648) 3541	unknown	Charcoal	Salvatori *pers. comm.* 1991
RH5		Grave 60	Bln-3150A	4850±60	3703 (3654) 3548	unknown	Charcoal	Salvatori *pers. comm.* 1991
RH5		Grave 19	Bln-2738	4860±60	3708 (3663) 3629	unknown	Charcoal	Salvatori *pers. comm.* 1991
RH5		Grave 215	Bln-3156	4920±60	3785 (3706) 3659	unknown	Charcoal	Isetti & Biagi 1989: 5

The dates marked with an asterisk (*) are not accepted by the present Author.
The dates obtained from charcoal are most probably from *Avicennia marina*.

Table 2

Site	Layer	Feature	Lab n°	BP date	cal BC date (1 σ)	δ 13C	Material	References
Qurm N	Surf.		Hv-14212	5229±160	4270 (4042) 3860	−2.7	Shells	Uerpmann 1992: 341
RH1*	Deposit		Hv-12976	2508±95	806 (766) 445	−22.9	Ashy sediments	Uerpmann 1992: 337
RH1	Surf.		Hv-12977	4571±105	3410 (3348) 3100	−3.1	Shells	Uerpmann 1992: 337
RH3	Surf.		P-2673	4030±70	2639 (2572, 2565, 2547) 2489	unknown	Charcoal	Biagi et al. 1984: 57
RH3	Surf.		P-2738	4170±220	3010 (2780) 2480	unknown	Charcoal	Biagi et al. 1984: 57
RH4	20cms		P-2741	4050±50	2610 (2578) 2488	+3.73	Charcoal	Meulengracht et al. 1981: 233
RH4	30cms		P-2740	4320±200	3210 (2956) 2680	unknown	Charcoal	Meulengracht et al. 1981: 233
RH4	2	Grave 11	P-2739	5140±200	4180 (3984) 3740	unknown	Charcoal	Meulengracht et al. 1981: 233
RH7	Surf.		Hv-10926	6876±105	5840 (5733) 5640	−1.2	*Arcidae*	Uerpmann 1992: 341
RH10*		Grave 105	Bln-2740	1810±50	126 (215) 247 AD	unknown	Charcoal	Unpublished
RH10*	1	Sq. EAF-EAM	Bln-2741	2050±50	125 (77) 4	unknown	Charcoal	Unpublished
RH10	1	Sq. EAG	Bln-2739	3550±60	1975 (1903) 1800	unknown	Charcoal	Biagi et al. 1984: 57
RH10	1	Grave fill	Hv-10003	3866±90	2486 (2360) 2210	−22.9	Ashy sediments	Biagi et al. 1984: 57
RH10		Sq. DJO-B	Hv-13197	4451±90	3334 (3088) 2947	−18.2	Charcoal	Uerpmann n.d.
RH10		Grave 121	Hv-10004	5121±65	3998 (3967) 3818	−18.2	Ashy sediments	Biagi et al. 1984: 57
RH10	2	Sq. DDJ	Hv-10002	6550±100	5550 (5487) 5370	+0.3	*Ostridae*	Biagi et al. 1984: 57
RH10	3	Sq. DDJ	Hv-10001	6713±105	5680 (5604) 5510	−0.2	Shells	Biagi et al. 1984: 57
RH10			Hv-13199	6443±105	5490 (5376) 5280	+0.5	Shells	Uerpmann 1992: 341
RH12	Surf.		Hv-13743	5776±100	4780 (4684) 4520	−1.8	Shells	Uerpmann 1992: 341

The dates marked with an asterisk (*) are not accepted by the present Author
The dates obtained from charcoal are most probably from *Avicennia marina*.

Table 3

Site	Layer	Feature	Lab n°	BP date	cal BC date (1 σ)	δ 13C	Material	References
RH6	Grave 1	Sq. B100	OxA-2629	3580±80	2042 (1933) 1838	−19.8	Human bones	Biagi & Nisbet in press
RH6	1	Pit A101	Bln-3636/I	5750±60	4776 (4726) 4681	unknown	*Terebralia palustris*	Biagi & Nisbet in press
RH6	1	Pit A101	Bln-3636/II	5890±60				
RH6	3	Sq. B100	Bln-4316	5750±60	4721 (4656, 4647, 4608) 4527	unknown	*Ziziphus* and terrestrial plants	Unpublished
RH6	3	Sq. B100	Bln-3640/I	5830±80	4829 (4785) 4726	unknown	*Anadara uropigimelana*	Biagi & Nisbet in press
RH6	3	Sq. B100	Bln-3640/II	5930±80				
RH6	3	Sq. B100	Bln-3641/I	5980±60	4922 (4863) 4804	unknown	*Terebralia palustris*	Biagi & Nisbet in press
RH6	3	Sq. B100	Bln-3641/II	5950±60				
RH6	3	Sq. B100	Bln-4315	5970±80	4965 (4874) 4793	unknown	*Avicennia marina*	Unpublished
RH6	9	Sq. X	Bln-3635/I	6230±70	5236 (5189) 5085	unknown	*Anadara uropigimelana*	Biagi & Nisbet in press
RH6	9	Sq. X	Bln-3635/II	6140±70				
RH6	9	Sq. X	Bln-3639/I	6340±60	5315 (5243) 5226	unknown	*Terebralia palustris*	Biagi & Nisbet in press
RH6	9	Sq. X	Bln-3639/II	6240±60				
RH6	11	Sq. X	Bln-3634/I	6130±60	5230 (5213) 5080	unknown	*Anadara uropigimelana*	Biagi & Nisbet in press
RH6	11	Sq. X	Bln-3634/II	6250±60				
RH6	11	Sq. X	Bln-3633/I	6140±60	5234 (5218) 5147	unknown	*Terebralia palustris*	Biagi & Nisbet in press
RH6	11	Sq. X	Bln-3633/II	6279±60				
RH6	13	Sq. X	Bln-3632/I	6240±70	5282 (5252) 5226	unknown	*Terebralia palustris*	Biagi & Nisbet in press
RH6	13	Sq. X	Bln-3632/II	6310±60				
RH6	14	Sq. X	Bln-3638/I	6360±60	5335 (5293, 5287, 5259) 5235	unknown	*Anadara uropigimelana*	Biagi & Nisbet in press
RH6	14	Sq. X	Bln-3638/II	6290±60				
RH6	14	Sq. X	Bln-3637/I	6420±80	5421 (5410) 5350	unknown	*Terebralia palustris*	Biagi & Nisbet in press
RH6	14	Sq. X	Bln-3637/II	6530±80				
RH6	top	W. trench	Hv-13195	5569±60	4480 (4396) 4358	−22.1	Ashy sediments	Uerpmann 1992: 344
RH6	50–100cms	W. trench	Hv-11629	5566±165	4600 (4415) 4280	−19.1	Fish bones	Biagi et al. 1984: 57
RH6	bottom	W. trench	Hv-13196	5992±80	4985 (4903) 4809	−19.8	Ashy sediments	Uerpmann 1992: 344

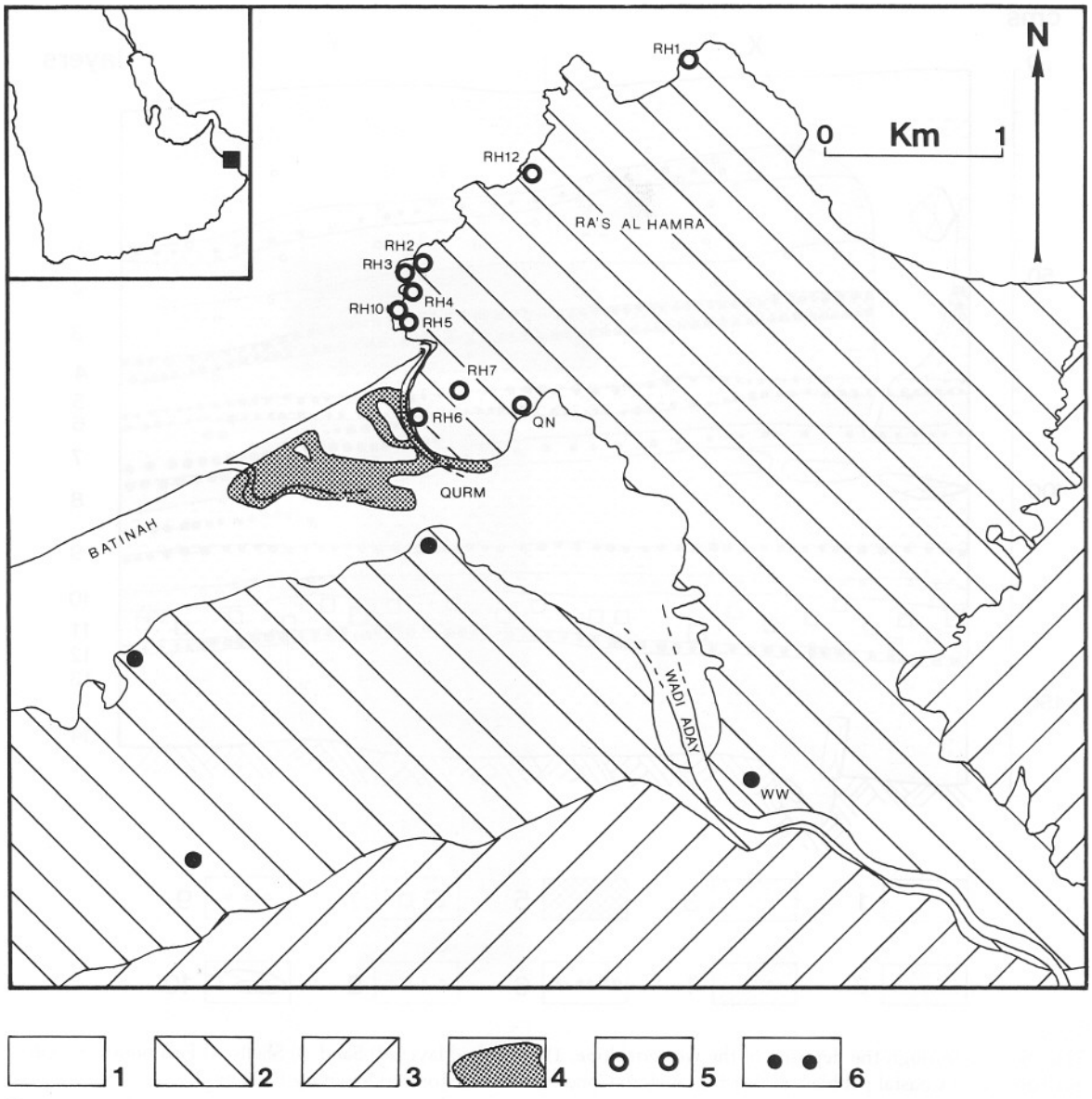

Fig. 1.
Radiocarbon sample archaeological sites along the coast of Ra's al-Hamra and Qurm. 1) Lowland zone. 2) Foothills. 3) Mountain zone. 4) Mangrove swamp. 5) 14C dated shell-middens. 6) Other sites in the area (Drawn by P. Biagi).

(9). This shell-mound was test-trenched for the first time in 1977. The excavations were later resumed in 1986 and 1988, revealing a very detailed sequence from which several 14C dates have been obtained (Table 3). In 1986, two trenches were opened, one along the western slope (Fig. 2), the second on the uppermost part of the site. The series discovered along the western slope was composed of fourteen layers that started to form towards the second half of the seventh millennium BP (10). The upper trench was interrupted when

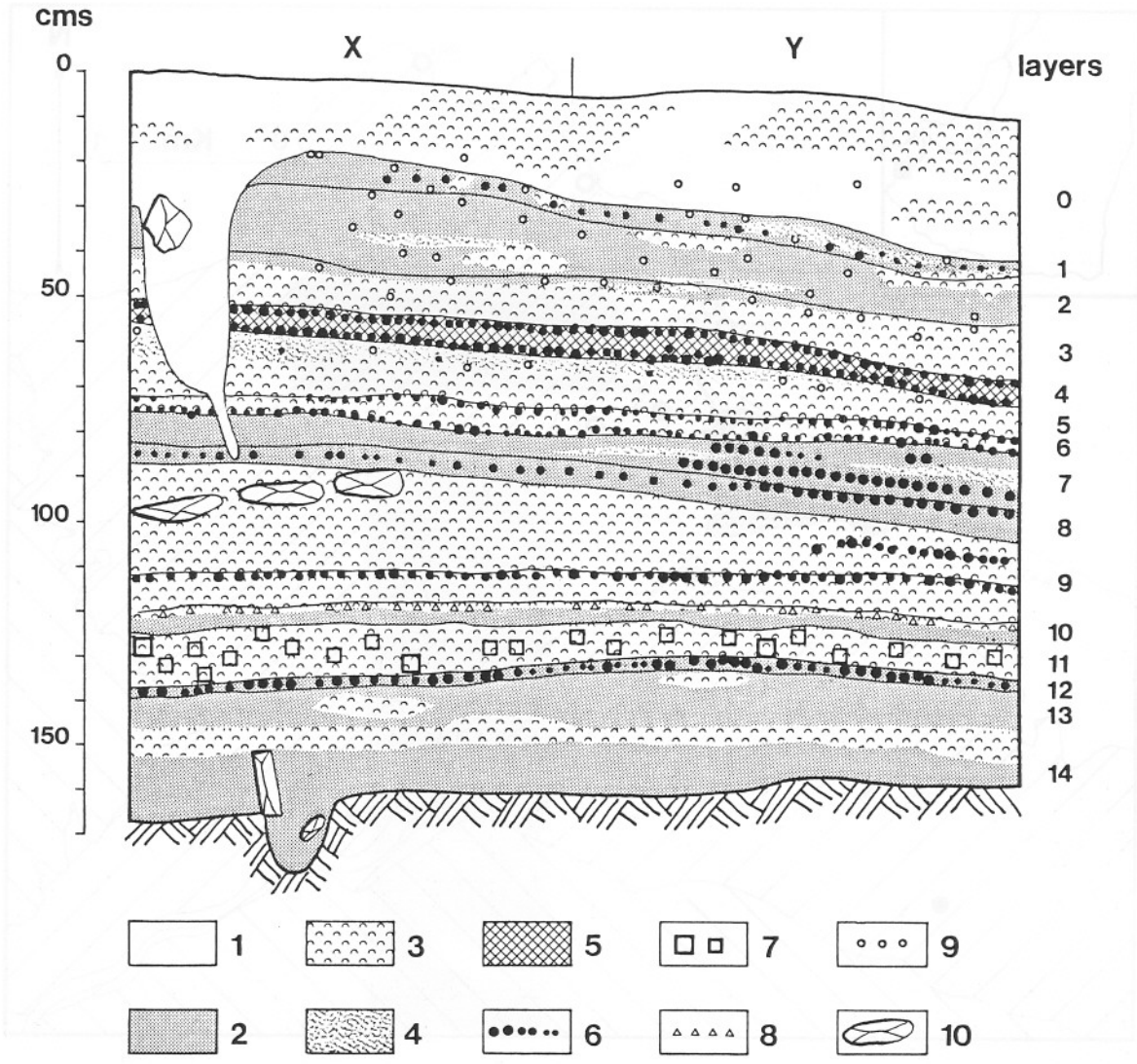

Fig. 2.
RH6. Section through the deposits of the western slope. 1) Disturbed layer. 2) Sand. 3) Shells. 4) Fish bones. 5) Ash. 6) Charcoal. 7) Coastal pebbles. 8) Beach gravel. 9) Concretions. 10) Stones (Drawn by P. Biagi).

evident traces of man-made features, such as post-holes, were recovered. The more recent aceramic layers were dated around the beginning of the sixth millennium BP. A double burial attributable to the Bronze Age, according to one radiocarbon date obtained from bone collagen, was found in the topmost layer (OxA-2629): 3580±80 BP: 2042 (1933) 1838 cal BC.

14C chronology of the other coastal sites (Table 4)

A few kilometres to the east of the Capital Area opens the bay of Bandar Khayran. During the coastal survey carried out in 1985, some shell-middens were discovered; others were recognized in 1990. These sites are characterized by scatters of *Anadara uropigimelana* (11) shells, among which lie a few stone arte-

Table 4 (16)

Site	Layer	Feature	Lab n°	BP date	cal BC date (1 σ)	δ 13C	Material	References
BJ1	Deposit		Hv-12974	4805±115	3720 (3630) 3430	−17.8	Ashy sediments	Uerpmann 1992: 337
BJ1	Surf.		Hv-12975	5516±105	4630 (4497) 4380	+2.0	Shells	Uerpmann 1992: 337
BK3	Surf.		Bln-3388/I	5210±60	4040 (4007) 3988	unknown	*Anadara uropigimelana*	Biagi 1988: 286
BK3	Surf.		Bln-3388/II	5210±60				
BK5	Surf.		Bln-3389/I	5580±50	4515 (4478) 4456	unknown	*Anadara uropigimelana*	Biagi 1988: 286
BK5	Surf.		Bln-3389/II	5700±60				
BK7	Surf.		Bln-3390/I	5200±70	4023 (3995) 3967	unknown	*Anadara uropigimelana*	Biagi 1988: 286
BK7	Surf.		Bln-3390/II	5140±70				
BK11	Surf.		Bln-3648/I	5720±60	4744 (4703) 4606	unknown	*Anadara uropigimelana*	Biagi 1988: 286
BK11	Surf.		Bln-3648/II	5870±60				
KM1	Surf.		ANU-2813	5130±90	4021 (3973) 3819	unknown	*Scapharca inaequivalvis*	Phillips & Wilkinson 1979: 110
DG1	Surf.		Bln-3392/I	4970±50	3797 (3779) 3710	unknown	*Anadara uropigimelana*	Biagi 1988: 287
DG1	Surf.		Bln-3392/II	4970±50				
DG			Hv-10922	6381±105	5440 (5335) 5240	−4.4	Shells	Uerpmann 1992: 341
DB1	Surf.		Bln-5270/I	5270±60	4251 (4235) 4146	unknown	*Anadara uropigimelana*	Biagi 1988: 287
DB1	Surf.		Bln-5270/II	5420±60				
GAS1	2		GX-17881	5127±80	4016 (3973) 3828	−18.9	Ashy sediments	Unpublished
BB1	Surf.		Bln-3391/I	4540±60	3369 (3352) 3331	+0.1	*Anadara uropigimelana*	Biagi 1988: 287
BB1	Surf.		Bln-3391/II	4620±60				
BB1	Deposit		Hv-10920	4811±75	3687 (3641) 3530	−19.1	Ashy sediments	Uerpmann 1992: 337
BB1	Surf.		Hv-10921	5648±115	4640 (4504) 4390	+0.5	Shells	Uerpmann 1992: 337
SHI3	Surf.		Bln-3650/I	4160±60	2866 (2626) 2590	unknown	*Anadara uropigimelana*	Biagi 1988: 287
SHI3	Surf.		Bln-3650/II	4040±60				
SHI4e	Surf.		Bln-3645/I	6050±70	4988 (4937) 4876	unknown	*Anadara uropigimelana*	Biagi 1988: 287
SHI4e	Surf.		Bln-3645/II	6000±70				
KJ12	Surf.		Bln-3615/I	4450±60	3375 (3358) 3338	unknown	*Anadara uropigimelana*	Biagi 1988: 288
KJ12	Surf.		Bln-3615/II	4740±60				
RJ2	SU 370	hearth	Beta-25907	4580±70	3394 (3356) 3158	unknown	Shells	Cleuziou & Tosi 1990: 11
RJ2	SU 370	hearth	Beta-25906	4600±70	3404 (3367) 3322	unknown	Shells	Cleuziou & Tosi 1990: 11
DFH2	Surf.		Bln-3643/I	5290±100	4313 (4252) 4165	unknown	*Terebralia palustris*	Biagi 1988: 289
DFH2	Surf.		Bln-3643/II	5400±60				
KHB1	Surf.		Bln-3642/I	4850±80	3652 (3552) 3513	unknown	*Marcia ceylonensis*	Biagi 1988: 289
KHB1	Surf.		Bln-3642/II	4690±80				
SAQ1	Surf.		Bln-3649/I	6040±60	4934 (4897) 4823	unknown	*Bullia mauritania*	Biagi 1988: 289
SAQ1	Surf.		Bln-3649/II	5920±60				
SRB1	Surf.		Bln-3702/I	4780±70	3672 (3634) 3546	unknown	*Marcia ceylonensis*	Biagi 1988: 289
SRB1	Surf.		Bln-3702/II	4859±70				
SHW1	Surf.		Bln-3644/I	6140±100	5240 (5213) 5092	unknown	*Marcia ceylonensis*	Biagi 1988: 290
SHW1	Surf.		Bln-3644/II	6220±60				

facts, almost exclusively chipped from quartzite and hyaline quartz. The dates obtained from four of these sites, namely BK3, BK5, BK7 and BK11 (Fig. 3), indicate that the bay was settled throughout the entire sixth millennium BP (12). Only a few shell-middens discovered along the coast between Quryat and the surroundings of Sur have been radiocarbon dated. The results mainly come from marine shells as in the case for Khawr Milkh 1 (KM1), Dagmar 1 (DG1), Dibab 1 (DB1), Bi'r Bira 1 (BB1), Shyia 3 (SHI3) and Shyia 4east (SHI4e). Only one date of Bi'r Bira 1 (BB1), was obtained from a sample of organic soil.

According to the available evidence, the shell-middens of this part of the Omani coast were settled during the sixth and the fifth millennia BP. This is also the case for *Anadara uropigimelana* middens along the shores of Khawr Jaramah, such as Khawr Jaramah 12 (KJ12). Much more recent dates come from the *Saccostrea cucullata* shell-mounds of Khawr Jaramah 4 (KJ4), Bln-3464/I, 1780±100 BP and Bln-3464/II, 1730±60 BP: average calibration: 225 (254, 298, 311) 365 AD, and Khawr Jaramah 100 (KJ100), Bln-3700/I, 1780±100 BP and Bln-3700/II, 1590±60 BP: average calibration: 347 (408) 432 AD, both of similar historical age (13). At Ra's al Junayz, just to the south of Ra's al Hadd (14), the aceramic layers, preceding the construction of the mud-brick building, gave results similar to those of KJ12 (15), whilst at ad Dhaffah (DFH2), a scatter of *Terebralia palustris* mangrove shells associated with a small assemblage of flint artefacts, produced two 14C dates of the mid sixth millennium BP. A few kilometres to the south, the site of Ra's al Khabbah 1 (KHB1) has been attributed to the first half of the fifth millennium BP. Early sixth millennium BP dates also come from the shell-midden of Ra's Shaqallah 1 (SAQ1); while those of Ra's Shirab (SRB1) and Shuwayr 1 (SHW1), in the Bay of Duqm, were settled at the beginning of the fifth and the end of the seventh millennium BP, respectively (Table 4) (Fig. 4).

The material assemblage

The best chronological sequence known so far for the Holocene prehistory of the Oman coast is that provided by the sites excavated between Ra's al-Hamra and Qurm. In this respect the shell-middens of RH6 and RH5 are of extreme importance. The chipped stone assemblage from the 1985–86 excavation at RH6 has been studied by R. Maggi (17) who

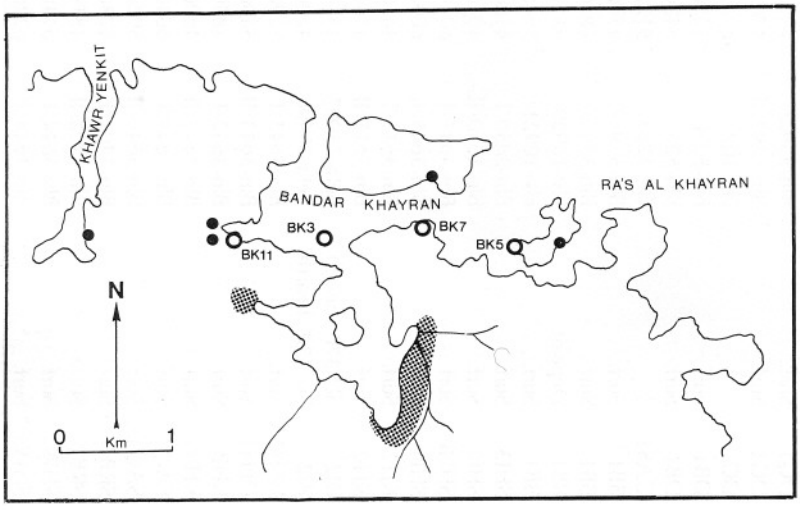

Fig. 3.
Radiocarbon sample archaeological sites in the bay of Bandar Khayran (BK3, BK5, BK7, BK11) in relation to the other shell-middens (dots). Shaded areas indicate actual mangroves (Drawn by P. Biagi).

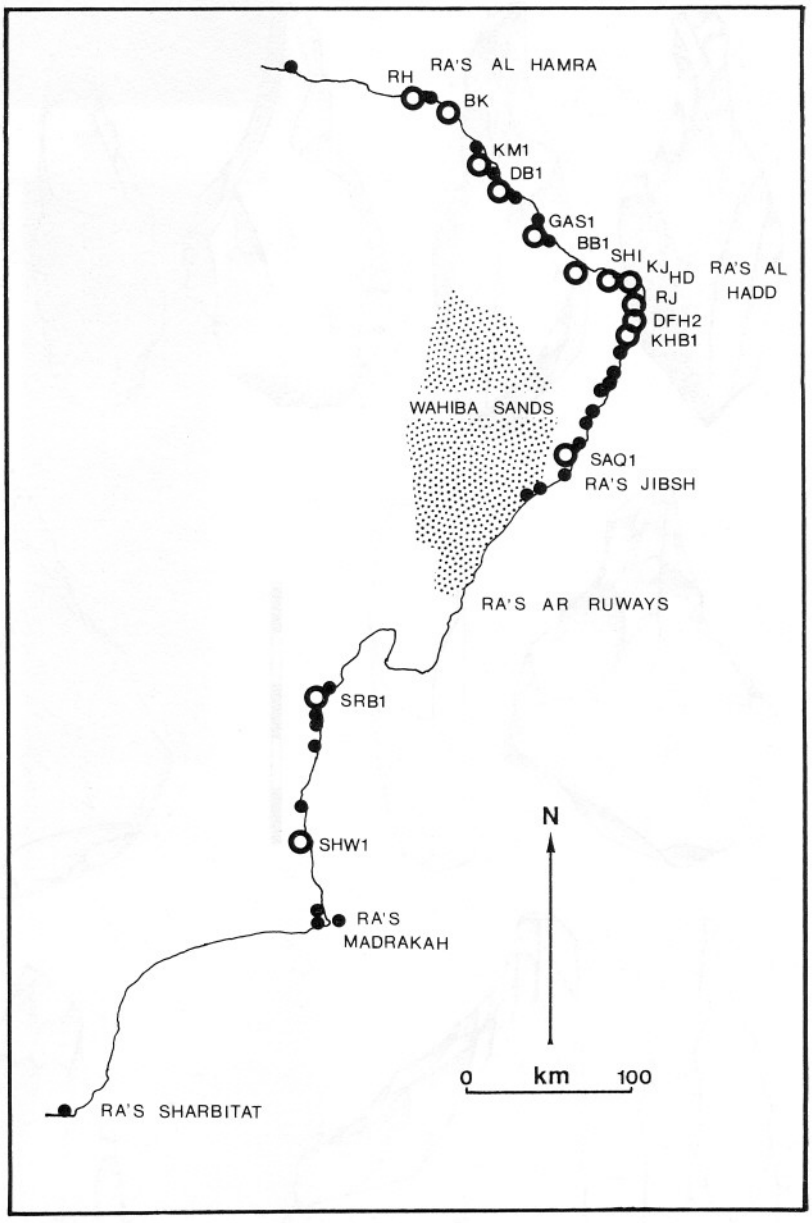

Fig. 4.
Radiocarbon sample archaeological sites along the coasts of Oman (circles) in relation to other shell-middens (dots) (Drawn by P. Biagi).

noted a strong variation in the raw material utilized throughout the centuries of occupation of the site. In particular, quartz artefacts are more represented in the lower layers, while those chipped from yellow flint are largely employed in the more recent horizons. This assemblage includes microlithic straight perforators, backed bladelets, end scrapers, side scrapers and rare flat retouched pieces, while "Ra's al-Hamra wedges" and *pièces ésquillées*, characteristic of the entire RH5 sequence (18), only appear with the final stages of settlement. These latter instruments are rather uncommon in the coastal Omani sites with the exception of those of Khor Milkh (KM1), Dibab (DB1) and Wadi Shab (GAS1).

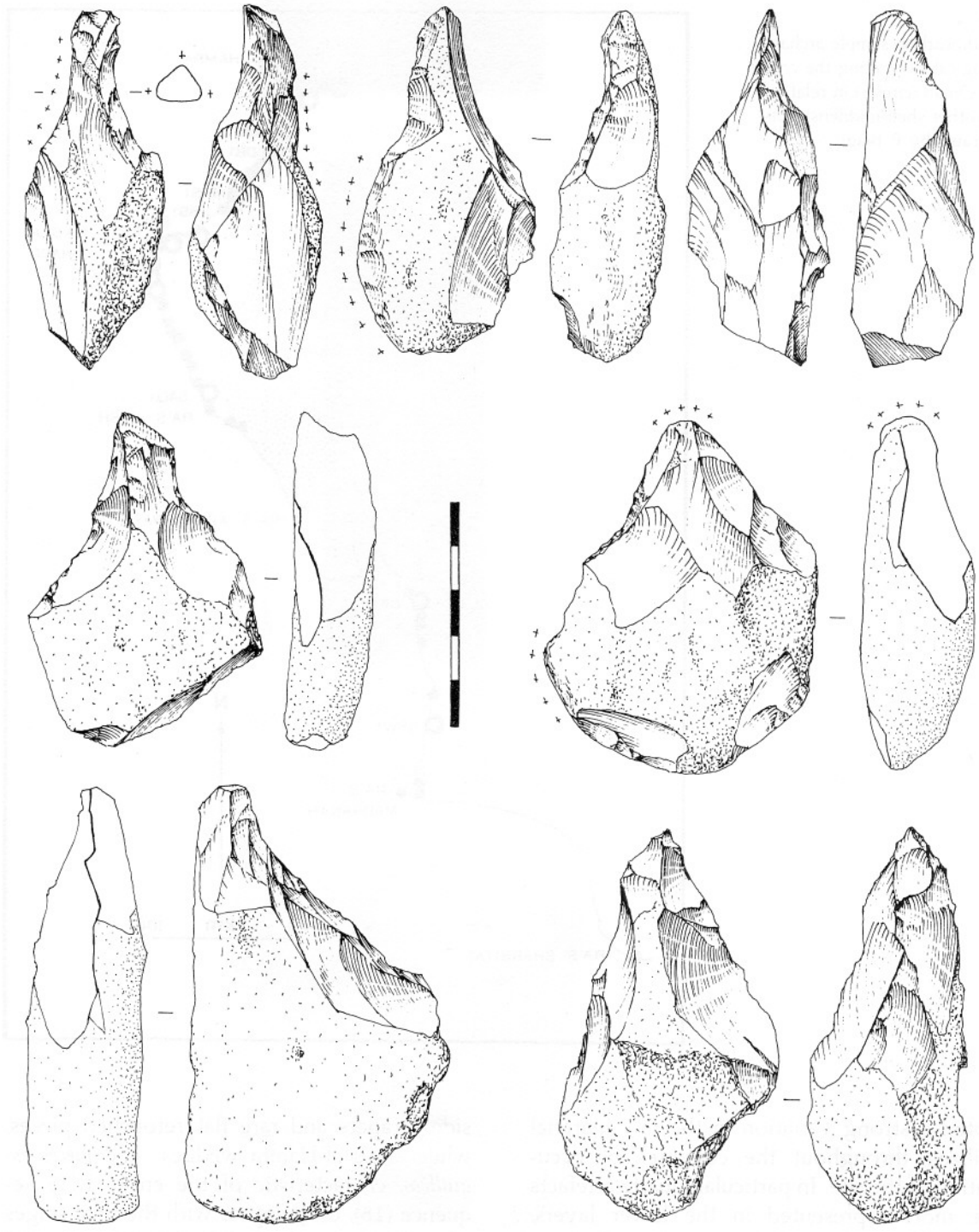

Fig. 5.
HD6. Bifacial thick points from surface (2:3) (Drawn by G. Almerigogna).

The most accurate attempt at chronological seriation of the lithic industries of Oman is that of M. Uerpmann (19), mainly based on the results obtained from the Tübingen Archaeological Expedition and from the research carried out by C. Edens and the writer along the southern coast (20). As regards the region surrounding the Capital Area, M. Uerpmann distinguishes five main *facies* of lithic industries spanning a period of some 7000 years. Even though many questions are still awaiting an answer, such as the moment of disappearance of flat retouched arrowheads like those collected at Ra's Shaqallah (SAQ1) and dated from shells to 6040±60 BP (Bln-3549/I) and 5920±60 BP (Bln-3649/II): average calibration 4934 (4897) 4823 cal BC, other problems are to be related to the activities carried out at the sites scattered over many hundred kilometres, sometimes lying in very different ecological zones as also reflected by differing species of shellfish visible on the surface. Specific instruments, which relate to well-defined activities such as the manufacture of pearl beads, are known from Wadi Shab (GAS1), dated to 5127±80 BP (GX-17881). Other peculiar assemblages come from the site of Ra's al-Junayz 30 (RJ30), which has a very high proportion of long, straight perforators obtained from blades (21), very similar to those from the more inland site of Ra's al-Junayz 37 (RJ37) (22); and from Ra's al-Hadd 6 (HD6), a shell-mound which produced a great number of thick bifacial points chipped from pebbles (Fig. 5).

Reservoir effects and radiocarbon age calibration

Many of the 14C dates of the shell-middens of coastal Oman have been obtained from marine or mangrove shell samples (Fig. 6). Since no $\Delta\rho$ value is currently available for this part of the Indian Ocean (23), the calibration of the Omani samples has been an open question for several years. In a recent work H.-P. Uerpmann has suggested a correction of 800 years for the shell dates. This assumption is based on the comparison between the results obtained at three different sites from shell and ash samples collected from the same archaeological layer (24).

As mentioned above, the shell-middens of RH5 and RH6 have been accurately dated, also with the specific purpose of analyzing different materials from the same level and

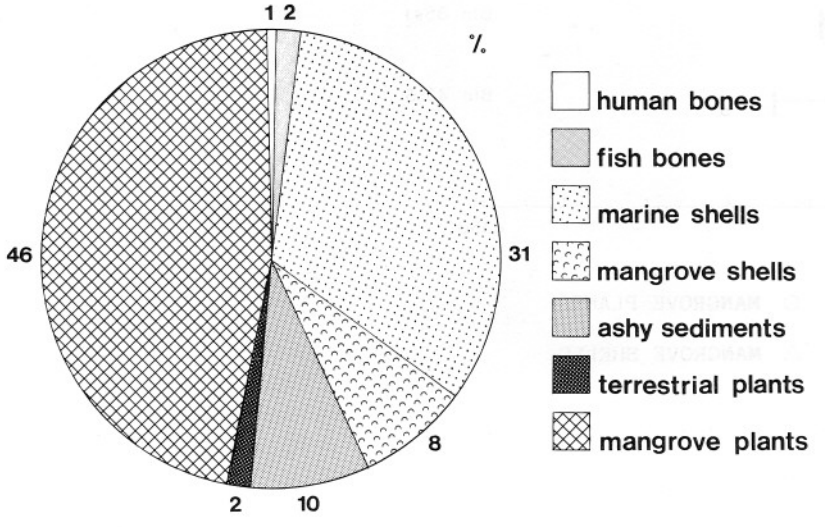

Fig. 6.
Percentage diagram of the materials employed for the radiocarbon dating of the aceramic Omani shell-middens mentioned in the text (Drawn by P. Biagi).

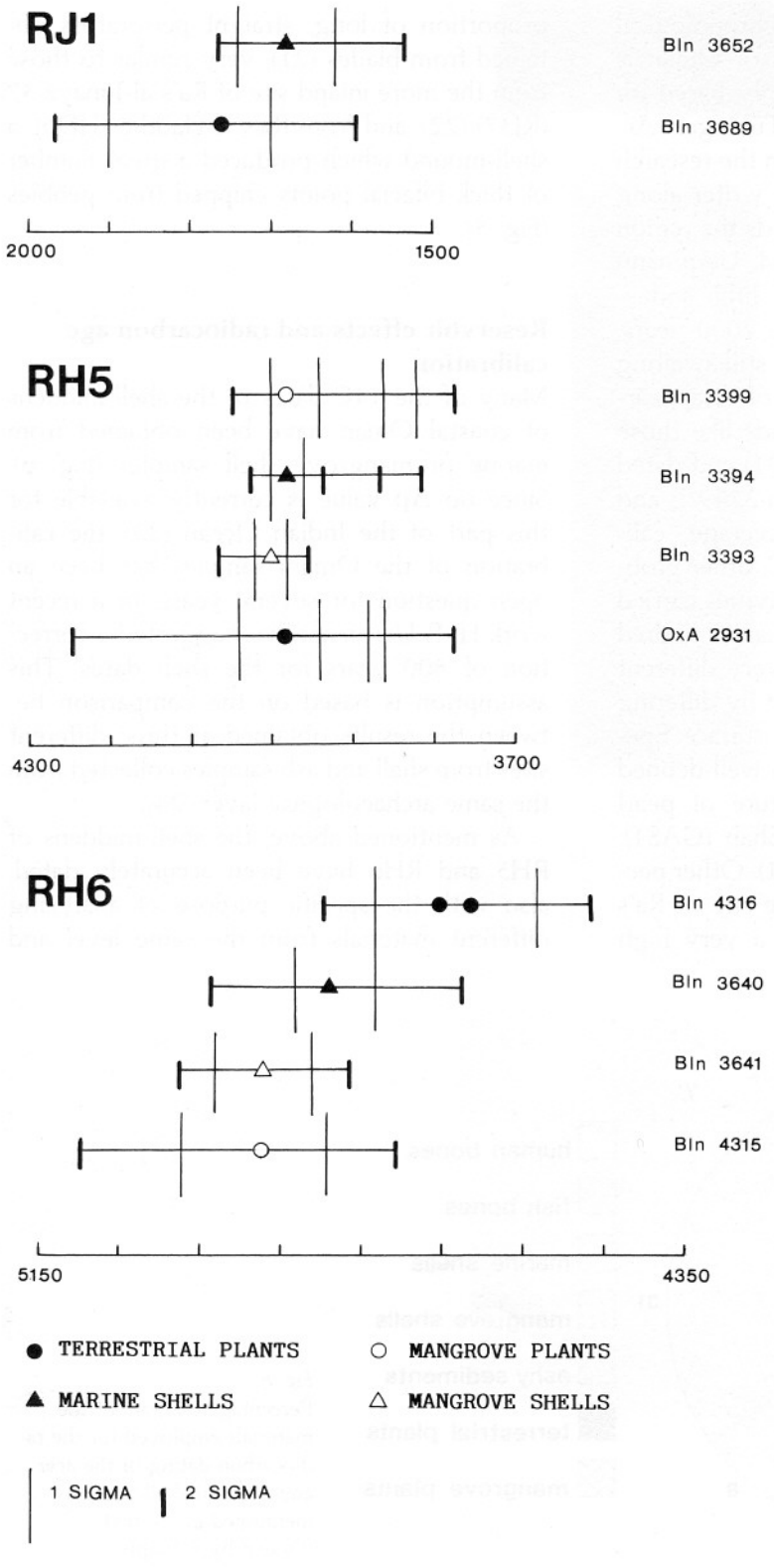

Fig. 7.
Calibrated 14C dates from RJ1 House 1 (above), RH5 layer 4 (centre) and RH6 layer 3 (below) (Drawn by P. Biagi).

comparing the results. More precisely, experimental dates have been obtained from RH6, layer 3 (Table 3) and from RH5, layer 4 (Table 1). These results are very similar for RH6, where the charcoals of *Ziziphus* and other terrestrial plants are some 200 years younger than the specimens of marine shells, mangrove shells and charred wood. Almost identical dates come from RH5, from which marine shells, mangrove shells and charcoals and one seed of *Setaria* have been dated. As shown in Fig. 7 these results are also supported by those from House 5 at RJ1 (25).

Considerations

The evidence to date demonstrates that the coast of Oman has been inhabited since the second half of the seventh millennium BP. Sites of this age are known both from the excavations carried out at Qurm and from the discoveries made along the coast to the north (SHI4e) and to the south of Ra's al Hadd (SHW1).

According to the most recent data, the appearance of the shell-midden sites might correspond to the climatic deterioration that, following a long pluvial period, started around 6500 BP and led, soon afterwards, to the current arid phase (26).

It is not easy to establish the provenance of these first communities of aceramic fisher-gatherers who settled along the coast of Oman. The search for better ecological zones such as those represented by the mouth of the *wadis* where mangrove swamps were already established, and where various environments could be exploited at the same time, might have played an important role. Earlier sites are not known in this territory, with the exception of that of Wadi Wutayya (WW), some three kilometres inland, along the right bank of Wadi Aday. The oldest of the sequence of dates from this site come from ash samples from two overimposed fire-places that were quoted to 9445±65 BP (Hv-12964), out of the calibration range, and 7183±85 BP (Hv-12963): 6117 (6034) 5976 cal BC yrs. Unfortunately the chipped stone industry from these levels is composed of a restricted number of tools. The upper layer 4 gave two dates, from ash and shells, respectively: 5698±100 BP: 4710 (4544) 4460 Cal BC (Hv-12965), and 6342±60 BP: 5350 (5312) 5237 Cal BC (Hv-12967) (27). They fit well into the range of those obtained from the shell-middens of the cape of Ra's al Hamra. The oldest sites of this area are those of RH6, RH7 and RH10, but, while RH6 was almost uninterruptedly settled for at least 800 years, the occupations of RH7 and RH10 seem to have been more episodic. Strong differences are to be noted also as regards the site locations. RH6 lies on the right mouth of Wadi Aday. Its margins are only seven metres above the highest level reached by the maximum tide (28). RH7 and RH10, in contrast, are located on the Tertiary terrace that was later settled for some 700 years by the RH5 communities. A great number of aceramic shell-middens seem to have been inhabited during the sixth and the fifth millennia BP, a period with coastal environment and climatic conditions almost identical to the present ones.

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11. Identified by Dr L. Mizzan of the Natural History Museum of Venice (Italy).
12. Two more dates are reported by Uerpmann H-P for the same unspecified site of Bandar Khayran. They are Hv-10923: 1370±50 BP: 633 (655) 676 cal AD (1σ) from ashy sediments and Hv-10924: 6412± 105: 5470 (5353) 5250 cal BC (1σ) from shells. See Uerpmann H-P. Radiocarbon dating of shell middens in the Sultanate of Oman. *PACT* 29: 1992: 337.
13. Biagi, Surveys along the Oman coast: 288.
14. A set of first-order radiocarbon dates has been obtained from shells recovered from HD1 at Ra's al-Hadd. (UCL-109) 4300±200 BP: 3307 (2915) 2619 cal BC, was obtained from the uppermost levels containing imported Harappan pottery; while the lower levels that yielded only one sherd of locally-made pottery gave the results of (UCL-108) 4900± 300 BP: 4030 (3708) 3380 cal BC and (UCL-122) 5600±500 BP: 5040 (4460) 3920 cal BC yrs. One sample of marine shells collected from the surface from the nearby aceramic shell-midden of HD2, dated with the same method, gave the result of 6100± 300 BP: 5350 (5036) 4690 cal BC yrs (UCL–125). See Glover E, Glover I & Vita-Finzi C. First order 14C dating of marine molluscs in archaeology. *Antiquity* 64 (244): 1990: 562–567; Reade J. Excavations at Ra's al-Hadd, 1988: Preliminary report. *The Joint Hadd Project. Summary Report on the Third Season. October 1987–February 1988:* 1990: 33–43.
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