

The Archaeological Heritage of Oman

# QALHAT, A MEDIEVAL PORT CITY OF OMAN

*From a field of ruins to UNESCO*

AXELLE ROUGEULLE

With contributions from:

THOMAS CREISSEN, VLADIMIR DABROWSKI, FABIEN LESGUER,  
ANAÏS MARRAST, HERVÉ MONCHOT, ALESSANDRA PERUZZETTO,  
HÉLÈNE RENEL

And the collaboration of the team of EVEHA INTERNATIONAL  
under the direction of Magalie Dartus and Daniel Etienne



Sultanate of Oman سلطنة عُمان  
**وزارة التراث والسياحة**  
Ministry of Heritage and Tourism



ARCHAEOPRESS PUBLISHING LTD

Summertown Pavilion  
18-24 Middle Way  
Summertown  
Oxford OX2 7LG  
[www.archaeopress.com](http://www.archaeopress.com)

Ministry of Heritage and Tourism  
Sultanate of Oman

P.O. Box 200, Postal Code 115  
Thaqafah Street  
Muscat, Sultanate of Oman

© Axelle Rougeulle 2023

Qalhat, A Medieval Port City of Oman: From a field of ruins to UNESCO  
(Includes bibliographical references and index).

1. Arabia. 2. Oman 3. Qalhat. 4. Islam 5. Indian Ocean.

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective agreements, no reproduction of any part may take place without the written permission of the Ministry of Heritage and Tourism, Sultanate of Oman.

First published 2023

ISBN: 978-1-80327-593-2  
ISBN: 978-1-80327-594-9 (ePdf)

All illustrations are © QP-QDP, except otherwise stated.

# Contents

<i>List of illustrations and tables</i>	vii
<i>Acknowledgments</i>	xv
<i>Introduction</i>	xvii
<b>1 History of research at Qalhat</b>	1
<b>2 Qalhat, rise and fall of an Omani port city, from the pre-Hormuzi to the Portuguese period</b>	11
<b>3 Urban planning of the town in the 14<sup>th</sup>-15<sup>th</sup> centuries</b>	22
<b>4 Qalhat, a heavily fortified city</b>	35
<b>5 Getting water in Qalhat, the water supply system of the town</b>	51
<b>6 The Great Mosque of Bibi Maryam</b>	59
<b>7 The Bibi Maryam mausoleum and other religious structures</b>	95
<b>8 Official and public buildings</b>	125
<b>9 Domestic life in Qalhat: The twin houses</b> <i>with Vladimir Dabrowski, Anaïs Marrast, Hervé Monchot and H������ Renel</i>	151
<b>10 Economy and trade</b> <i>with Thomas Creissen, Fabien Lesguer and H������ Renel</i>	186
<b>11 Qalhat, a World Heritage site</b> <i>with Alessandra Peruzzetto</i>	213
<i>Bibliography</i>	217
<i>Index</i>	225



# List of illustrations

## MAPS

- |      |                         |       |
|------|-------------------------|-------|
| 1.1. | Location map of Qalhat. | xviii |
|------|-------------------------|-------|

## FIGURES

- |      |   |    |
|------|---|----|
| 1.1. | The ruins of Qalhat from the east with the Bibi Maryam mausoleum in the background.   | 1  |
| 1.2. | Aerial view of the site from the east (© MHT).  | 3  |
| 1.3. | Evacuation of rubble from the excavations of building B21.  | 4  |
| 1.4. | The Cartographic Project: A-B) Differential GPS survey (CNRS-Archéorient); C-D) Drone and pole photogrammetry (Iconem).   | 6  |
| 1.5. | Preliminary map of the site from the 2008-2010 Cartographic Project surveys of the surface (orange: buildings / purple: courtyards / yellow: terraces / green: enclosures / blue: cisterns and <i>wadis</i> / black spots: graves). | 7  |
| 1.6. | The site storage area: A) Containers and building for the storage and conservation of excavation of material and tools (left), excavation rubble storage area sorted for conservation (right); B) Inside view of the storehouse.    | 8  |
| 1.7. | Material registration and studies: A-C) Sorting, washing and drying of excavated material after fieldwork; D) Field data recording; E) Ceramic study; F) Flotation for micro-fauna and botanical sampling.                          | 9  |
| 2.1. | Location of Qalhat and Sur according to Al-Idrisi's map, c. 1165 (from Sousa 1974), the north is down.  | 12 |
| 2.2. | Decorated Indian <i>chapati</i> stone trays, from building B38 (left), and the twin houses B94/K (right).   | 17 |
| 2.3. | Stone cannonball, most probably Portuguese, found in a late layer of room B in the southern house of B94 (dia. 8.9cm).  | 19 |
| 3.1. | Aerial view of Qalhat from the northwest (© MHT).   | 22 |
| 3.2. | Tentative map of the 14 <sup>th</sup> /15 <sup>th</sup> centuries city showing the different quarters and main excavated buildings.   | 24 |
| 3.3. | Detailed plan of the city center, 2016 (grey: building / white: courtyard).   | 25 |
| 3.4. | Ancient houses in Al-Hamra (© Al-Salimi <i>et al.</i> 2008: 185).   | 26 |

3.5.	Aerial view of the northeast quarter.	27
3.6.	Aerial view of the south quarter.	28
3.7.	Aerial view of the northwest quarter.	29
3.8.	Aerial view of the west quarter from the west.	30
3.9.	Aerial view of the south plateau from the north.	31
3.10.	Typical masonries at Qalhat (east façade of the twin houses B94).	32
3.11.	Masonries in B21.	33
3.12.	Timber from collapse layers in the Great Mosque reused from boat frames.	33
4.1.	The fortifications of Qalhat in the 1220s according to Ibn Al-Mujawir (from Smith 2008: 271, fig.13) and a sketch plan of the actual fortifications.	35
4.2.	Section of the soundings in the corner of walls B6 and B7.	36
4.3.	The southwest wall B7 after clearing.	37
4.4.	The eastern end of the southwest wall B7 and the bastion on the beach.	38
4.5.	Access staircase to the walkway of the southwest wall.	38
4.6.	The northwest fortification wall B5 astride the crest of Wadi Hilm bank.	39
4.7.	The intermediary wall B6 (A) and a conduit across the wall (B).	40
4.8.	Plan of tower B24 on the beach.	41
4.9.	A terracing wall on the shore, acting as a fortification, with tower B24 in the background.	41
4.10.	Zenithal view of the western tip of the city in the corner of the fortification walls B5 and B7, showing the fortified northwest gate of the city with the hammam (B4), the interior cistern (B2), the Bibi Maryam mausoleum complex (B1), and the late enclosure (B3).	43
4.11.	The main south gate of the city (B8) with a funerary terrace in the foreground (Chapter 6).	44
4.12.	Kite view of the area of the west gate (B31) in the intermediary wall (B6), before excavations, with a small postern further south.	45
4.13.	The advanced south wall (B10) before the construction of the highway (courtesy T. Vosmer).	46
4.14.	Masonry of B10.	46
4.15.	Kite view of the gate in the advanced south wall, the east flanking tower, and the parapet at the top of the cliff.	47
4.16.	Plan of the northern look-out post.	48
4.17.	Sections of the coast visible from the northern (up) and southern (down) look-out posts.	49
4.18.	The southern look-out post.	50
4.19.	Ruins of a circular tower on the north bank of Wadi Hilm.	50
5.1.	The Sakherat cistern.	52
5.2.	Wadi Hilm upstream from Qalhat.	52
5.3.	The <i>intra muros</i> cistern B2.	53
5.4.	The watersheds of cisterns B2 and B9.	54

5.5.	The exterior cistern B9: A) Kite view of the cistern and its catchment; B) View of the cistern from the southwest.	55
5.6.	The interior <i>wadis</i> : A) Small catchment dam inside the south <i>wadi</i> ; B) Retaining walls and small cistern along the bank of the north <i>wadi</i> .	57
6.1.	Excavation at the Great Mosque: A) First dig on what will turn out to be the <i>qibla</i> wall of the Qalhat Great Mosque (B12, sounding S1, 15/11/2008); the west courtyard is on the left, the ruins of building B13 at the back, and the surrounding dwellings of the central quarter on the west and north ridges in the background; B) Zenithal view of the Great Mosque at the end of the excavations (26/12/2017).	60
6.2.	Side view of the ruins of the mosque from the north.	61
6.3.	Plan of the Great Mosque complex.	62
6.4.	View of the complex from the end of the main street at the top of the western ridge with the small mausoleum B197 in the foreground, the ruins of B13 to the left, and the ruins of the mosque in the background on the right.	63
6.5.	The west gate of the complex and detail of the standing slab on the north side of the entrance.	64
6.6.	A probable private ablution area at the bottom of the staircase against the northwest corner of the mosque (12J, left), and a public one in the north wing of the low courtyard (12P, right, see below).	65
6.7.	Tentative restitution of the porch to the east hall from collapsed fragments (in light grey) (V. Bernard); small pinnacle and fragment of the glazed frieze found collapsed at ground level.	66
6.8.	Kashan luster tiles and carved wooden elements from the north façade and doors of the mosque found collapsed at ground level.	66
6.9.	Fragments of polygonal columns from the east hall collapsed at ground level in rooms 12H and 12K of the basement.	67
6.10.	Tentative restitution of the wall between the east hall and the prayer hall according to fragments found in the collapse layer (V. Bernard).	67
6.11.	Fragments of an engaged column of the gate to the prayer hall, collapsed at ground level, cubic base missing (V. Bernard).	69
6.12.	Restitution of a central column and arch under the dome from fragments collapsed at ground level in corridor 12B of the basement (V. Bernard).	70
6.13.	A lateral column of the prayer hall collapsed at ground level in room 12F.	71
6.14.	Restitution of two lateral engaged columns against the south wall from fragments collapsed at ground level in the south street (V. Bernard), with tentative restitution of the window in-between.	72
6.15.	The bases of the columns or pillars in the last arcade along the <i>qibla</i> wall showing the imprints of the decorative panels on the east front side.	72
6.16.	Fragment of a beam with carved inscription possibly from the roof of the prayer hall.	73
6.17.	Tentative restitution of the dome over the center of the prayer hall from fragments found in the collapse layer (V. Bernard); collapsed fragment of the fan vault.	74
6.18.	Decorative elements found in the area of the <i>mihrab</i> and <i>minbar</i> : A) Elements of a mortar frieze, possibly from the top of the <i>mihrab</i> niche; B) Moulded panel with inlaid fragments of glazed tiles; C) Fragments of various inscriptions from the vicinity of the	75

*mihrab* niche (triangles with moulded *mhd* inscription/fragment of a turquoise Kashan tile with inscription in relief/fragments of a large mortar inscription, probably from the top or around the *mihrab* niche); D) Elements of decoration from inside the *mihrab*, phase 2 (fragment of a claustra/twisted colonette/moulded panels with inlaid fragments of Kashan tiles); E) Star and cross mosaic from a plinth at the base of the *qibla* wall; F) Gold luster Kashan tile at the base of the *qibla* wall against the south side of the *mihrab*, phase 1, *in situ* under the mortar panels decoration of phase 2; G) Frieze of moulded panels at the base of the *minbar*, phases 2-3.

6.19.	West end of the axial nave showing the successive stages of the <i>mihrab</i> , <i>minbar</i> and floors of the prayer hall.	76
6.20.	E-W photogrammetric section of the excavated ruins and the restored elevation of the mosque.	78
6.21.	Detailed plan of the ruins of the mosque and north courtyard.	79
6.22.	The basement corridor 12B from the north.	81
6.23.	The south entrance to the corridor with a reused tombstone in the threshold and the imprints of beams for a door frame.	81
6.24.	Room 12C in span 3 with the collapsed fragment of a central column.	82
6.25.	Room 12Q in span 2 with post holes and a collapsed fragment of the wall between the east hall and the prayer hall.	83
6.26.	Fragments of decoration found in the collapse layer of the minaret and a tentative restitution (V. Bernard).	84
6.27.	Tentative restitution model of the Great Mosque from the north (© OAAM/Base Models).	86
6.28.	Fragments of moulds for the decoration of the spandrels of the arches under the dome found over the last floor of the prayer hall.	89
6.29.	A small bronze bell and the fragment of a stemmed glass found in the area of the minaret and the building on the sea.	89
6.30.	Fragments of a blue and white porcelain plate embedded in collapsed masonry from the area under the dome.	90
6.31.	Graffiti from the wall of the east hall showing a plan of the Great Mosque of Qalhat, c. 1300? (restituted parts in light grey).	91
7.1.	Location map of the small mosques (red circles: platform mosques; green circle: courtyard mosque).	96
7.2.	The ruins of mosque B132 at the top of the bank of the north interior <i>wadi</i> .	97
7.3.	Mosque B19: A) General view from the southwest before conservation works; B) Plan.	97
7.4.	Mosque B29: A) General view from the east; B) Photogrammetry.	98
7.5.	B19, backfills of the platforms under the prayer hall and the courtyard.	99
7.6.	East façade and access staircase of B19 during conservation works.	100
7.7.	B19, the prayer hall and the <i>mihrab</i> from the courtyard.	101
7.8.	Zenithal view of the north part of graveyard C6 showing the courtyard mosque B67 and other structures, a platform mosque (B65), two mausoleum complexes (B70, B71), grave enclosures (B66, B69, B72), and isolated graves.	102
7.9.	Plan of the courtyard mosque B67 showing the early (dark grey) and late (light grey) phases.	104



7.10.	B67, ceramic assemblage from the backfills of the first phase (end of the 13 <sup>th</sup> -beginning of the 14 <sup>th</sup> century) (H. Renel).	105
7.11.	The funerary quarters from the Cartographical Project survey: A) Map of the cemeteries; B) Detailed plan of cemeteries C2 and C3.	107
7.12.	Various grave types in Qalhat: A) Simple grave; B) Raised oval grave; C) Raised rectangular grave; D) Stepped rectangular grave; E-F) Slab graves.	108
7.13.	Plan of cemetery C1 (© Vosmer 2003).	109
7.14.	The funerary terrace B64 in C7.	110
7.15.	Photogrammetric view of mausoleum B115 from the north.	112
7.16.	Ancient photograph of the small mausoleums west of graveyard C2 (© MHT).	113
7.17.	Mausoleum B109: A) Outside view after conservation works; B) Inside view showing the graffiti of a boat above the squinch.	113
7.18.	Structure B197 on the slope of the ridge over the Great Mosque complex with the large west street in the foreground and the end of the city's main street on top of the ridge.	114
7.19.	The Bibi Maryam mausoleum.	115
7.20.	The Bibi Maryam mausoleum, photogrammetry (Iconem) and tentative restitution of the façades (drawing P. Anselm).	117
7.21.	Photogrammetric E-W section of the mausoleum showing the inside north wall and the crypt (Iconem); tentative restitution of the inside decoration (drawing P. Anselm).	119
7.22.	Remains of glazed tiles decoration on the south wall: A) Vertical frieze of stars and crosses on the east jamb of the door; B) Imprints of a mosaic of stars and crosses under a horizontal frieze of square tiles on the wall to the west of the door.	119
7.23.	Fourteenth century incense burner in the shape of the Bibi Maryam mausoleum with an inscription bearing the name of Maryam on the dome.	123
8.1.	Building B13: A) Kite view before excavations from the southwest; B) Schematic plan according to the cartographic survey.	126
8.2.	The south wall and southeast corner tower of B13 on the north side of the west courtyard of the Great Mosque.	127
8.3.	Collapsed masonry over the ruins of B14 at the top of the notch in the plateau, before the Iranian excavations.	128
8.4.	Sketch plan of the Iranian excavations at B14 (© Iranian Archaeological Mission, courtesy Dr Javery).	129
8.5.	The walled-up arch under the collapsed masonry, west side of the Iranian excavations.	130
8.6.	An inscription and fragments of turquoise and lajvardina Kashan glazed tiles from the Iranian excavations.	130
8.7.	Sketch plan of the B14 complex according to surface surveys.	131
8.8.	Kite view of B16-B17 (© MHT).	133
8.9.	Sketch plan of B16.	134
8.10.	The northeast corner of the <i>majlis</i> in B16 (S3).	135
8.11.	The <i>hammam</i> area from the west before the 2003 excavations (courtesy T. Creissen).	138
8.12.	General view of the <i>hammam</i> from the east.	139

8.13.	The <i>hammam</i> : A) Zenithal view during the conservation work; B) Plan.	140
8.14.	General view of room 4D.	141
8.15.	The tub in room 4A.	141
8.16.	Schematic plan of the <i>hammam</i> : ground level with hypocausts (down) and upper main floor (up).	143
8.17.	The northern hypocaust: A) East part under the central room 4C; B) West part under the hot rooms 4F-G.	144
8.18.	Zenithal view of the western massif in the service area with the fire chamber and tanks.	144
8.19.	Section through the fire chamber showing layers of ash preserved at the bottom.	145
8.20.	The well west of the <i>hammam</i> .	146
8.21.	Photogrammetric plan of the <i>hammam</i> showing the water circulation systems (red: hot water / blue: cold water / green: waste water).	147
8.22.	The hot and cold water circulation systems from the tanks and on the benches, and the waste water canalization from the basin in room 4E.	148
9.1.	General view of B94 from the south before (A) and after (B) excavation, with building B21 (Chapter 9) in the background.	152
9.2.	General view of room 94M from the north showing the remains of the early building walls on the bedrock, and the access to the room, high in the east wall to the left.	153
9.3.	Plan of the twin houses B94 (light grey: masonry; dark grey: pits/hearths/post-holes; ochre: coating, except floors; yellow: early building).	154
9.4.	The north house: A) The entrance room 94F: the doors, the staircase and the closet in the background, the benches and the cistern in the foreground; B) The courtyard 94D: the bedrock and successive floors, the canal structure of phase 2 in the background, the foundation of phase 3 in the foreground, and the billot of phase 4 in the center; C) Stone anchor found in the courtyard; D) The room with the jars 94D; E) Room 94A: the leveled basins of phase 1 in the foreground and the bench of phase 2 to the right (the baulk in the southwest corner was left in place to prevent the south wall from collapsing).	156
9.5.	The south house: A) West part of the entrance room 94L: the staircase and the west bench, and room 94R in the background; B) Room 94Q with the post-holes; C) The <i>madbasa</i> in room 94B; D) The courtyard 94I in phase 2: the aligned post-holes in the background and the hearths in the foreground; E) Room 94G to the east of the courtyard: the partition wall with the courtyard in the background, the north doubling wall to the right, and the phase 3 floor on top of the backfill to the left; F) The northeast room 94P: the wall of the early building on the bedrock, the cross wall of phase 1 above it, the tank and part of the phase 2 floor at the top of the backfill.	158
9.6.	Tentative schematic plans of the different floors of the twin houses.	163
9.7.	The buttress at the southeast corner of the twin houses.	164
9.8.	Proportions of local and imported ceramics in B94: A) In the end of the 13 <sup>th</sup> - first half of the 14 <sup>th</sup> century; B) In the 16 <sup>th</sup> century.	165
9.9.	Ceramics in B94 (end of the 13 <sup>th</sup> – first half of 14 <sup>th</sup> century) from: 1-5) Qalhat pottery B41: glazed and unglazed production; 6-13) India: jars and pots; 14-16) Yemen: 'Mustard Ware' yellow glazed bowls; 17-22) Iran: buff jugs, jars and bowls; 23-31) China: Dehua porcelain and Longquan green stoneware bowls.	167

9.10.	Ceramics in B94 (16 <sup>th</sup> century) from: 1-11) Qalhat: unglazed and glazed production; 12-15) Bahla: brown speckled glazed bowls; 16-18) Lower Gulf: glazed bowls; 19-20) UAE: cooking pots; 21-22) Bahrain: jars; 23) Yemen: bowl with slip painted decoration under a blue glaze; 24) India: pot; 25-29) Iran: buff jars and jugs with incised or molded decoration; 30-33) China: blue and white porcelain; 34-35) Thailand: greyish stoneware bowls; 36) Burma: bowl with a cream glaze on a red body.	169
9.11.	Ceramic assemblage from the collapse in room 94M (UF 1434), from: A) Qalhat kilns: unglazed and glazed bowls, jugs and jars; B) Bahla: brown speckled glaze pot and bowls, some with an incised decoration; C) UAE and Lower Gulf: cooking pots, some with a painted decoration, large glazed plates; D) Iran: buff incised and molded jars and jugs, frit wares bowls with underglaze painting; E) India: pots and jars, some with paddle stamped decoration; F) China: blue and white porcelain bowl, plate and cups.	170
9.12.	Cooking and serving in B94: 1) Soapstone cooking pot; 2) Soapstone box; 3) Sandstone <i>chapati</i> tray; 4-6) Ceramic incense burners; 7-9) Copper bowls; 10-36) Glass vessels.	172
9.13.	Tools: 1-10) Grinding tools; 11-12) Ceramic spindle whorls; 13) Glass weight (?); 14) Ceramic crucible; 15) Stone cast mold.	173
9.14.	Objects: 1-13) Iron and copper alloys hardware (nails, blades, pegs, chains, staples); 14-17) Iron arrowheads; 18-23) Ornaments (copper alloy pendant, charms, belt buckle and finger ring; carnelian archer ring); 24-27) Glass bangles; 28-31) Ceramic and bone game tokens, ceramic figurines.	175
9.15.	Seeds and fruit remains found in building B94. A) Grain of hexaploid wheat ( <i>Triticum aestivum/durum/turgidum</i> ) in dorsal, lateral and ventral view; B) Grain of Asian rice ( <i>Oryza sativa</i> ) in dorsal, lateral and ventral view; C) Grain of finger millet ( <i>Eleusine coracana</i> ssp. <i>coracana</i> ) in basal and dorsal view; D) Grain of hulled barley ( <i>Hordeum vulgare</i> ) in dorsal, lateral and ventral view; E) Split cotyledon of mung/urid bean ( <i>Vigna radiata/mungo</i> ) seen from outer and inner sides; F) Split cotyledon of cowpea ( <i>Vigna unguiculata</i> ) seen from outer and inner sides; G) Pomegranate ( <i>Punica granatum</i> ) seed seen from two sides; H) Grape ( <i>Vitis vinifera</i> ssp. <i>vinifera</i> ) pip in dorsal and ventral view; I) Peppercorn ( <i>Piper nigrum</i> ); J) Akene of celery ( <i>Apium graveolens</i> ).	177
9.16.	Distribution of the main taxa for the B94 fish bones study. Results are presented by chronological phase (1: early building; 2: main occupation of the twin houses; 3: late occupation of the twin houses); and by percentage of NIS (blue: pelagic fish; yellow: demersal fish).	183
9.17.	Two vertebrae of <i>Istiophorus platypterus</i> , from room B94F.	184
9.18.	Fish shopping workbench, Sur fish market, Sultanate of Oman, 2015 (© Ph. Béarez, A. Marrast).	184
10.1.	Wasters and tripods from the ceramic workshop B41.	187
10.2.	Waster of glazed tiles in the shape of a cross.	187
10.3.	The ceramic workshop at the end of excavations: A) Photogrammetry; B) Plan.	188
10.4.	View of space 41E under excavation from the west.	189
10.5.	Ceramic production of the workshop, closed forms (types 1x: glazed; 2x: unglazed): A) Large jars; B) Small jars; C) Jugs, bottle and pots.	190
10.6.	Ceramic production of the workshop, open forms (types 1x: glazed; 2x: unglazed): A) Bowls; B) Basins and lamps.	191
10.7.	Updraft kilns: A) Kiln B41-03 (2008); B) A firing in a traditional updraft kiln in the Dakhla oasis, Egypt (© Henein 1997, cover photo).	192

10.8.	The craftsmen's workshop B39: A) Photogrammetry; B) Plan.	195
10.9.	The east façade of B39 with the outside floor cut for the digging of latrine for late squatters in the foreground.	196
10.10.	Room 39E: A) General view at the end of the excavations; B) The phase 2/2 jar oven.	196
10.11.	Area 39D at the end of the excavations.	197
10.12.	Rooms 39A (right) and 39B (left) in phase 2, stages 1 and 2.	198
10.13.	Objects found on the last floor of room 39A: 1) Oyster shell; 2) Bivalve shell with tar inside; 3-4) Crucibles; 5) Stone mold for making metallic jewelry; 6-7) Copper alloy weights; 8) Needle; 9) Pin ring; 10) Partly polished turquoise fragment; 11-12) Raw carnelian stones; 13) Pestle; 14) Grinding stone.	199
10.14.	Charred fragments of the roof of the jewellers' workshop showing prints of palm mats and stems.	200
10.15.	Kite view of B21 from the northwest with the nearby twin houses (B94) to the south and the potters and craftsmen' workshops (B41 and B39) further south.	201
10.16.	The 'store' (?) B21: A) The north wing before excavation; B) The west wing after excavation.	201
10.17.	B21: A) Zenithal view; B) Plan in phase 1; C) Plan in phases 2 and 2'.	202
10.18.	The outside room 21T in phase 2.	203
10.19.	The entrance corridor 21I.	204
10.20.	Rooms 21J-K and courtyard 21H2 in phases 1 and 2.	204
10.21.	Stratigraphy of room 21B.	205
10.22.	The <i>madbasa</i> in room 21L.	206
10.23.	The area of the central <i>suq</i> from the north with building B13 in the background.	208
10.24.	Plan of the excavated part of the <i>suq</i> (B140-141).	209
10.25.	Landing platform cut at the foot of Wadi Hilm bank.	211
10.26.	OLNG tugs in front of the site.	211

## TABLES

9.1.	Mammal and bird species of the building B94 according to the different rooms (Ext.: exterior; SURF: surface).	180
9.2.	Anatomical distribution of the fish bones.	182
9.3.	Distribution of the main taxa for the B94 fish bones study. Results are presented by chronological phase, NISP and % of NISP.	182

## Acknowledgments

*This book is dedicated to Vincent Bernard (1960-2017), architect of the Qalhat Projects*

This volume is the result of ten years of research at Qalhat that would not have been possible without the backing of many individuals and institutions.

The Qalhat Project (2008-2016) and the Qalhat Development Project (2013-2016) were carried out under the high authority of the then Minister of Heritage and Culture of Oman, His Majesty Sultan Sayyid Haitham bin Tarik Al-Said. Our warmest thanks go to the current Minister, at the time Undersecretary for Heritage, H.E. Salim Mohammed Almahruqi, and to all the members of the General Directorate for their involvement and support. We are particularly grateful to Ms. Biubwa Ali Al-Sabri, former Director of the Department of Excavations and Archaeological Studies, who initiated the Project in 2007; to Sultan Saif Nasser Al-Bakri, Director General of Archaeology, who was one of the three members of the first preliminary expedition in the spring of 2008, and who has remained deeply involved in research at Qalhat since then; to H.E. Hassan bin Mohammed bin Ali Al-Lawati, former Advisor to the Minister for Heritage Affairs, for his dynamic and resourceful support in development and UNESCO projects at the site. Our warmest thanks also go to Mr Khamis Al-Asmi, Director of the Department of Excavations and Archaeological Studies and to Mr Sultan Al-Maqbali, Director of the World Heritage Sites Department. Mr Mohamed Hamed Al-Waili, coordinator of the Qalhat Projects in the Ministry in Muscat, and Mr Khamis Nasser Al-'Amri, local project coordinator of the Department in the Sur region, have been invaluable and friendly backings throughout the works. We would also like to warmly thank Tom Vosmer, who very kindly provided us with all the documentation from his previous expeditions at Qalhat. Special thanks to Ibtisam Abdullah Al-Mamari, Director of the World Heritage Department, for the editorial coordination and careful review of the final manuscript of this book.

Research at Qalhat was also supported by the French National Centre for Scientific Research (CNRS), and especially by the UMR Orient & Méditerranée and the National Museum for Natural History (MNHN), to which most of the specialists involved in the Projects belong; its financial and scientific investment has been invaluable; backing was also provided by the Archaeological Committee of the French Ministry of Foreign Affairs. The research also benefited considerably from the strong involvement of the French archaeological agency Eveha, which participated in the QP missions from the start and was then in charge of the QDP excavations. Likewise, the great implication of World Monuments Fund (WMF) for the conservation and development of the site has been essential for the preservation of Qalhat and its nomination on the UNESCO World Heritage List. Special thanks are also due to the Total Foundation, which provided the necessary funds for the Cartographical Project; the maps issued from this project were used as a basis for most of the work on the site.

Above all, this volume is the fruit of the joint work and unfailing investment of all the members of the QP and QDP teams:

Juliette André (Eveha, 2013-2016), Patrick Anselm (Abako Arkitektkontor, 2008a), Guillaume Auger (Eveha, 2013-2014), Gabrielle Choimet (2011), Magalie Dartus (Eveha field director, 2011, 2013-2014), Sanae Es-Safi (Eveha, 2015-2016), Daniel Etienne (Eveha field director, 2013-2016), Virgile Ferbourg (2013-2014, 2016), Pauline Gaubert (2010), Corinne Gosset (Eveha, 2013-2016), Nolwenn Gilbert (2013-2014), Aurélien Hamel (2009), Boris Hollemaert (Eveha, 2008), Anna Ihr (Göteborg University, 2008, 2010-2011), Jérôme Janky (Eveha, 2016), Anne Joyard (2008-2010), Fabien Lesguer (Eveha, 2013-2016), Sterenn Le Maguer (2012, 2015), Ronald Schwerdtner (Eveha, 2015), Romain Séguier (Eveha, 2015-2016), Apolline Vernet (Eveha, 2011-2013), archaeologists.

Olivier Barge and Emmanuelle Régagnon, (CNRS-Archéorient, 2008-2010), Yves Ubelmann and Philippe Bartélémy (Iconem, 2013-2014/), cartographers.

Vladimir Dabrowski and Jérôme Ros, archaeobotanists (CNRS-AASPE/MNHN, 2014-2015), Anaïs Marrast, ichthyologist (CNRS-AASPE/MNHN), Hervé Monchot, archaeozoologist (CNRS-O&M, 2013-2014), Gülsu Simsek, physical chemist (CNRS-MONARIS, 2013).

And the team of the WMF: Alessandra Peruzzetto, conservation project manager (2013-2017); Pierre Blanchard (2013-2014), Tristan Schebat (2014-2016) and Pablo Longoria (2017-2018), heritage architects; Chamsia Sadozaï (2013-2014), Vincent Bernard (2014-2018) and Ludovic Thibout (2018-2019), site supervisors; Cristina Vazio, Maddalena Costantino, Laura Famiglietti, Nicolo Marchetti, Fabio Porzio, conservators; and Stefano Massimino, structural engineer (2018-2019).

And the three pillars of the QP and QDP: Thomas Creissen, head of Eveha International, archaeologist (2008-2016), Hélène Renel, research engineer at CNRS-O&M, ceramologist, draughtswoman (2008-2016), and Vincent Bernard, archaeologist, topographer, draughtsman and specialist of Islamic architecture (2009-2015).

To all of them, we are greatly indebted.

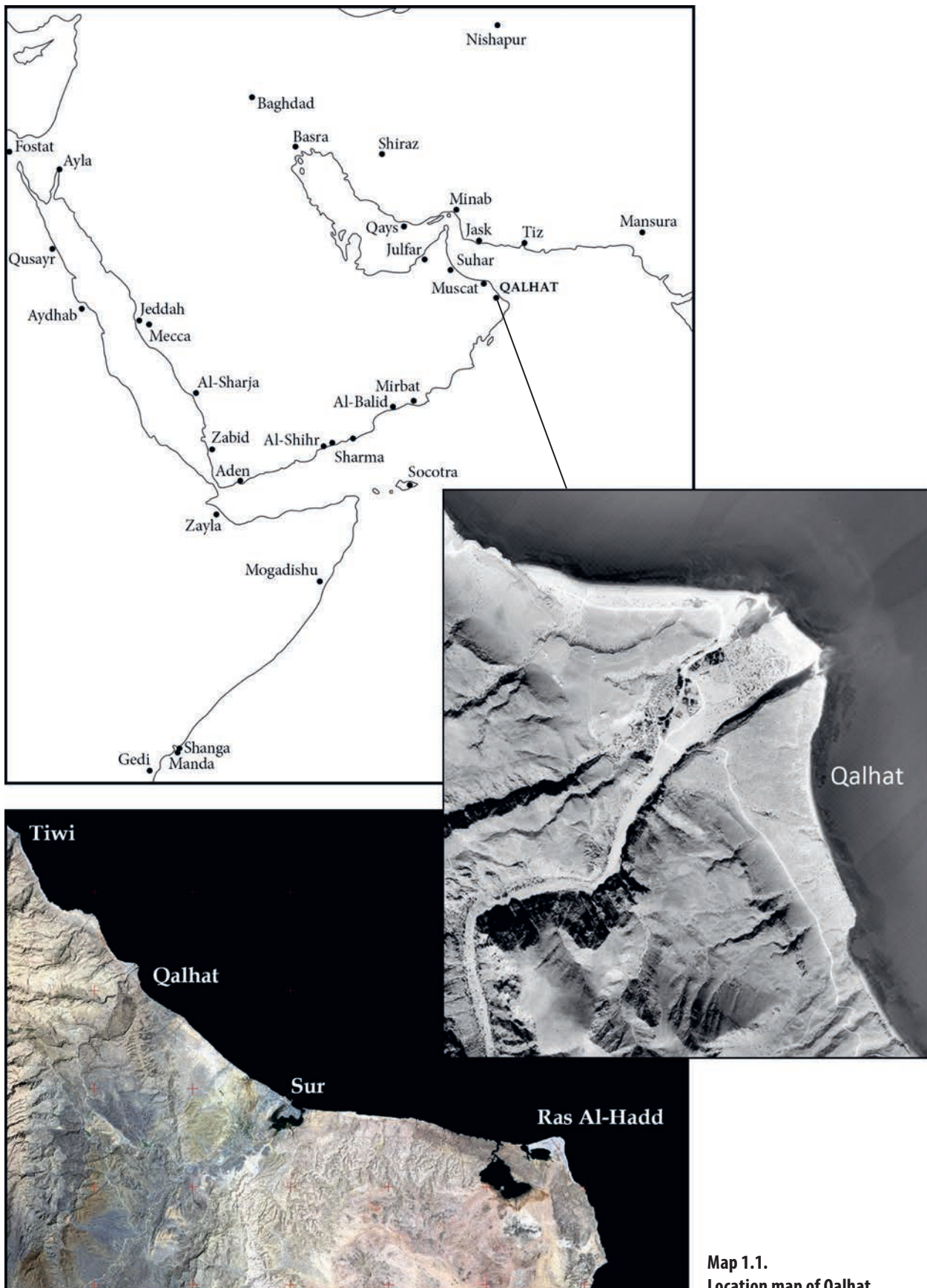


# Introduction

Qalhat (22° 41' 41" N, 59° 22' 35" E) is located on the coastal plain of the Ash Sharqiyyah South Governorate, about 50km to the northwest of Ras Al-Hadd, the easternmost tip of the Arabian Peninsula, and 25km from the city of Sur (see the Location map of Qalhat). It is definitely one of the main archaeological sites of Oman, a huge field of ruins, all that remains of a famous port city from medieval times. Its history, ranging from the 11<sup>th</sup>/12<sup>th</sup> centuries to the 16<sup>th</sup> century AD, is documented in contemporary texts which highlight its key importance in the history of Oman and the Indian Ocean trade, particularly during the time when it was the twin capital of the kingdom of Hormuz, in the 13<sup>th</sup>-15<sup>th</sup> centuries (below, Chapter 2). The town has never been reoccupied since its abandonment at the end of the 16<sup>th</sup> century, thus lying untouched under its own ruins which cover 35ha, enclosed in fortification walls. Qalhat therefore constitutes a unique and extremely precious testimony of this period, especially since the ancient city of Hormuz itself has long been totally destroyed.

Even though Qalhat has always been known as one of Oman's major heritage sites, it was mainly because of the Bibi Maryam mausoleum, the only monument still surviving on the site: a unique example of medieval Islamic architecture, this mausoleum stands at the foot of the mountain, along the ancient coastal track from Sur to Qurayyat, and it was a mandatory stopover for travelers on this route. But very few were aware of the existence of the city itself, the ruins of which stretches between the mausoleum and the seashore. In fact, the site has long remained poorly documented even from a scientific point of view (Chapter 1).

Ash Sharqiyyah South Governorate, and in particular the region of Sur, has recently experienced very significant economic development. At the northwest end of the Sur plain, 5km from the site, several huge industrial complexes including the Oman LNG Qalhat Terminal plant have been installed since 2000 and the city of Sur has known a great expansion. In the early 2000s, the construction of a highway between Sur and Qurayyat was initiated to replace the old coastal track winding through the narrow coastal plain between the mountains of Al-Hajar Al-Sharqi and the Arabian Sea. Some 25km north of Sur, on the south bank of Wadi Hilm, Qalhat was lying across the plain, on the originally planned route of the highway. Thanks to an additional allocation from the Omani authorities, the new road was deviated up the slope of the mountain, an impressive bridge was built across the *wadi*, and the site was saved. At the same time (2005-2006) restoration work was carried out by the Ministry of Heritage and Culture (MHC, now Heritage and Tourism) at the Bibi Maryam mausoleum. And in 2008 the MHC finally launched a project of extensive archaeological research at the site (Chapters 3 to 10), which eventually led in 2018 to the nomination of Qalhat on the UNESCO World Heritage List (Chapter 11).



Map 1.1.  
Location map of Qalhat.



## Chapter 1

# History of Research at Qalhat

### Early studies

The first modern description of the ruined city of Qalhat is by the British J.R. Wellsted, a member of the Bombay Marine, who achieved in the fall of 1835 an extended journey through Oman. From Muscat he sailed to Sur but had to anchor for a few hours off Qalhat (*Kilhât*) due to strong winds, and he took the opportunity to land at the site. He noted the great extension of the ruins where only ‘a small mosque’ remains ‘in a state of tolerable preservation’. Fortunately, he had time to walk to this building, in fact the mausoleum of Bibi Maryam (Figure 1.1), of which he gives an interesting description (Wellsted 1838, I: 41-42; see below, Chapter 7). Wellstedt also mentions that the inhabitants of the present village north of the site used to search the ruins for gold coins, some of them bearing ‘the name of the Caliph Haroun Al-Rashid’. This assertion seems rather false because, first the site does not seem to have ever been looted; second, no coins other than copper or lead have been found at the site since excavation began; and third, and most importantly, the founding of Qalhat is at least three centuries later than the reign of Haroun Al-Rashid (below, Chapter 2).



Figure 1.1. The ruins of Qalhat from the east with the Bibi Maryam mausoleum in the background.

Forty years later, in September 1874, the British political agent and consul in Muscat S.B. Miles visited Qalhat (*Kilhat*) and provided more detailed information on the site, as on the lower course of Wadi Hilm (Miles 1919: 473-475, 526-530, the same visit is described in two different chapters, under different words). He described the mausoleum as well as a nearby vaulted cistern and the southwest fortification wall. He also mentioned the 'foundations' of many houses in 'coral and cobbles', 'the walls of a few still partly standing', which suggests that the site was then in a better state of conservation as standing walls are now almost completely lacking (Figure 1.1). He considered the towers and ruins standing on the north bank of Wadi Hilm as the 'chief part of the old town', where he found the fragment of an inscription, although he adds that he did not 'inspect this part properly'. Inside the *wadi* was the modern village of Kilhat, 'now merely a fishing village, inhabited by the Shaaban, a petty tribe of 200 souls' (or Saabiyeen, with 300 inhabitants, in the other part of the text).

After Miles, Qalhat disappeared from records for more than 120 years, until the late 1990s. In 1997, a survey of the coast between Qurayyat and Sur produced only general information about the site and the mausoleum, which is wrongly identified as the city's Great Mosque (Ibrahim and ElMahi 2000: 130-135). Pottery wasters were also discovered at two places, but their location is not specified. A year later, a much more detailed study of the site was carried out by the team of the Oman Maritime Heritage Project directed by Tom Vosmer, which was mainly devoted to underwater survey (Vosmer *et al.* 1998). A 100m wide strip of seabed in front of the site was surveyed by visual and remote-sensing searches and more than 20 stone anchors were recorded, most of them located in front of the beach (Chapter 10); a detailed ethno-archaeological study of this specific medieval artefact was also carried out. Some land surveys with differential GPS allow the plotting of the fortifications line and of some buildings along the shore, including a large one near the northern tip of the site which has been tentatively identified as the Great Mosque; in fact, it is a wide edifice with courtyards and a large *majlis*, possibly the palace of the governor of the city according to recent excavations (B16, Chapter 8). During the same period, historical information about the site was published (Al-Zadjali 1997a-b, 1998a-b). Finally, the study of the navigation history of the site and of the region was initiated (Agius 1999). During the same period, notes were also published by Paolo Costa (2002) about the Bibi Maryam mausoleum and the possible location of the Great Mosque.

The real archaeological study of Qalhat began in 2003, when an Omani-Australian team led by T. Vosmer, under the authority of the Oman Ministry of Heritage and Culture (MHC), achieved a single season of excavation on the site (Vosmer 2004). Additional efforts were devoted to underwater surveys using different technics, but the main research was made on land. Kite photo coverage has been launched (below). Some of the main elements of the site were recorded, the city-walls, the cisterns, and the graveyards. Two tombs dated to the Late Iron Age Samad period have been excavated some distance to the southeast of the site, and two stratigraphic soundings were dug in the northeast part near the mouth of Wadi Hilm. But the most interesting discovery was that of a *hammam*, located in the area of the northwest gate of the city, along the track climbing the bank of the *wadi* up to the site (Chapter 8). This unique and complex structure was partly excavated and mapped, and eventually mostly backfilled for protection, but unfortunately it was not studied in detail then and the Project was stopped. At the same time as these excavations, a technical description of the Bibi Maryam mausoleum was carried out by E. d'Errico to prepare the conservation works that took place in 2005-2006 (d'Errico 2003). An in-depth study of literary sources on Qalhat has also been undertaken (Bhacker and Bhacker 2004).



## **The Qalhat Project (QP, 2008-2016) and Qalhat Development Project (QDP, 2013-2016)**

### *The Qalhat Project excavations*

Considering the upcoming opening of the highway (completed in 2009) and the major importance of Qalhat in the history and heritage of Oman, the Ministry of Heritage and Culture (from 2020 Heritage and Tourism) decided in 2007 to launch a long-term archaeological research project at the site. At the invitation of the MHC, Dr Hassan Fazeli Nashli, then Director of the Iranian Cultural Heritage and Tourism Organization (ICHTO, Teheran), and Dr Axelle Rougeulle, member of the French National Centre for Scientific Research (CNRS, Paris), paid a preliminary visit to Qalhat in 2007, and the five-year Qalhat Project (QP) was consequently launched in 2008. During the first year, excavations were carried out by both a French team and an Iranian team, which also initiated conservation work on three small mausoleums in the exterior funerary quarter (Chapter 7). Following the withdrawal of the Iranian team, the QP went on as an Omani-French project. After a short preliminary season in spring 2008, five excavation seasons were conducted in 2008-2012, about one and a half month each fall, with a team of seven to nine archaeologists and specialists led by Dr A. Rougeulle under the authority of the MHC. They were co-financed by the MHC, the CNRS and the Archaeological Committee of the French Ministry of Foreign Affairs, with the support of the French archaeological agency Eveha.

The site of Qalhat appears like a vast ocean of collapsed small limestone blocks, cobbles and coral, with elongated heaps of stones, like waves, in all directions; not a single clear feature appears on the surface, and only a few wall alignments are discernible (Figure 1.1). But the heaps are clues to underlying walls, as shown in the aerial views where many buildings are clearly visible and the general town planning appears (Figure 1.2).



**Figure 1.2. Aerial view of the site from the east (© MHT).**



**Figure 1.3. Evacuation of rubble from the excavations of building B21.**

The first objective of the QP was therefore to carry out a cartographic study of the site to help understand the spatial organization of the city, an essential tool to drive the course of the excavations (below). On the basis of these cartographic documents, restricted excavations were carried out in what seemed to be noteworthy buildings in order to obtain the widest possible range of information about the medieval town; it should be noted that, in addition to their assumed importance, the excavated buildings were also to be located along one of the two modern tracks opened through the site by fishermen some decades ago, which were the only possible means of removing excavated rubble from the site (Figure 1.3). Although carried out on a somewhat small scale for such a vast site, this work has yielded varied and interesting evidence on the spatial organization and development of the city, the daily life of the inhabitants and their activities, the regional and international trade networks of the port. Surface surveys have made it possible to identify the main characteristics of the town's urban planning, and soundings have provided data on the function and chronological evolution of the different quarters (Rougeulle 2010). The defensive system, the water supply system, and the funerary quarters, were studied. The Great Mosque has been discovered and tested, along with several other main buildings (Rougeulle, Creissen and Bernard 2012). The study of the archaeological material, and in particular of the local and imported ceramics, allowed a preliminary chronology of the site and the identification of the main commercial links of the harbour. A second QP five-year period was initiated in 2013 on a reduced scale, parallel to the QDP (below), to complete our knowledge of the medieval city as a whole, with additional surface studies and excavation tests in new areas.

#### *The Qalhat Development Project, excavations and conservation*

Given the results of the QP, the MHC launched in January 2013 a new five-year project (2013-2017), with the final objective of creating an archaeological park on the site. The Qalhat Development Project (QDP) was led and supported by the Ministry, under the scientific direction of the author. Its aim was to excavate



and clear extensively some important buildings discovered during the QP excavations, then to carry out conservation work for their presentation to the public in the future park. It therefore included an excavation component, carried out by the CNRS and the archaeological agency Eveha International under the direction of Dr A. Rougeulle; a conservation component, carried out by World Monuments Fund (WMF) under the direction of A. Peruzzetto; and a tourist development component which has yet to be initiated.

The excavation and conservation works were planned to take place side by side in six-month seasons, from October to March, divided into two campaigns (Rougeulle 2016). Following a break in 2014b/2015a, and a premature stop in 2016, only two and a half seasons of excavation took place (2013a; 2013b/2014a; 2015b/2016a), with a team of six archaeologists from the Eveha International Agency, several specialists from the CNRS and a team of 30 to 40 workers. Regarding the conservation component, four and a half seasons of conservation were carried out (2013b/2014a; 2014b/2015a; 2015b/2016a, 2017b/2018a, 2019a), with a stonemason and an architect from World Monuments Fund, and a team of c. 20 masons and workers. Three buildings in the northwest quarter of the city, a group of two houses (B94), a large construction interpreted as a store (B21) and a small platform mosque (B19), have been fully excavated and conserved, as well as a courtyard mosque in the funerary quarter (B67), all previously tested during the QP. In the western quarter, the extensive excavation of two nearby jewellers' (B39) and potters' (B41) workshops, also brought to light during the QP, was achieved, as well as that of the west gate of the city (B30) and of a small platform mosque nearby (B29), all awaiting conservation works. The conservation of the *hammam* (B4), the excavation of which began during the Omani-Australian mission in 2003 and was finalized during the 2015b/2016a QDP season, has been completed, as well as the necessary reconstruction of the terracing fortification wall of the city underneath (B133). A large cistern outside the south city wall (B9) was also consolidated. The extensive excavation of the large Great Mosque complex on the shore (B12), which monopolized much of the QP and QDP task force, has been completed and conservation work is underway.

### *The Cartographic Project*

The only topographic documents available at the start of the QP were a black and white aerial photo and a 2m contour line map of the site provided by the MHC, as well as a, incomplete set of kite photographs taken during the 2003 Australian expedition.<sup>1</sup> Thanks to a three-year grant from the Total Foundation,<sup>2</sup> the detailed cartographic study of the site was undertaken in 2008-2010 by two CNRS cartographers (E. Régagnon and O. Barge, Archéorient, Lyon). During the first season, the topographical map of the surface was carried out, the site was entirely surveyed with a differential GPS following a 10m grid, a 20m grid for the surroundings; contour line maps as well as a digital elevation model (DEM) were produced. In the following years, a Geographic Information System (GIS) of the site was produced, based on a Digital GPS recording of all discernible topographic features (heaps of stones, void areas or alignments, terraces, visible structures as fortifications or graves ...) (Figure 1.4A-B). When the surface was too chaotic, main streets alignments and blocs of buildings were first identified on the kite photo coverings, both vertical and oblique, taken in the same seasons and then digitized with GIS software and transferred to the GPS receiver, the photointerpretation finally controlled on the field (Régagnon and Barge 2011; Barge and Régagnon 2012). All this lead to the production of preliminary city maps showing the main architectural units, the approximate layout and interior plans of the buildings, and the circulation networks, with a varying reliability gradient depending on the technique used (Figure 1.5). The cartographical project also conducted in 2010 a survey of the plateau south of the city and of Wadi Hilm upstream of Qalhat (Chapters 3 and 5).

Based on this city map, a detailed surface study of the central quarter was launched in 2013; being the most formerly and densely populated part of the city, and chiefly built on sloping ground, this quarter was the most illegible on the surface and so the least reliable on the map, while the surrounding areas appeared much more clearly on cartographic documents (Chapter 3). All the registered buildings of this quarter were therefore identified and studied on the ground, each line of wall discernible on the surface was cleared, the plans were corrected and completed by hand as much as possible. A further cartographical survey was then carried out in 2016, to enter these new data on the database and correct the preliminary plans and the general map of the quarter, a work which unfortunately could not be fully completed before the end of the project.

But the main objective of the Cartographic Project during the QDP was to carry out photogrammetric surveys to produce 3D models that could be used as a support for archaeological study, archival conservation, publication and development, particularly in the perspective of the archaeological park and a UNESCO candidature. Three field seasons (2013a, 2014a, 2017b) were carried out by the French company Iconem. The entire surface of the site and its surroundings was scanned using a drone (Figure 1.4C), with a definition of 3 to 5cm/pixel, and all main features and excavated buildings were digitalized by drone and pole (Figure 1.4D), with a definition of 0.5 to 1cm/pixel, before and after conservation work, either by Iconem or by the topographers of the Eveha archaeological team.

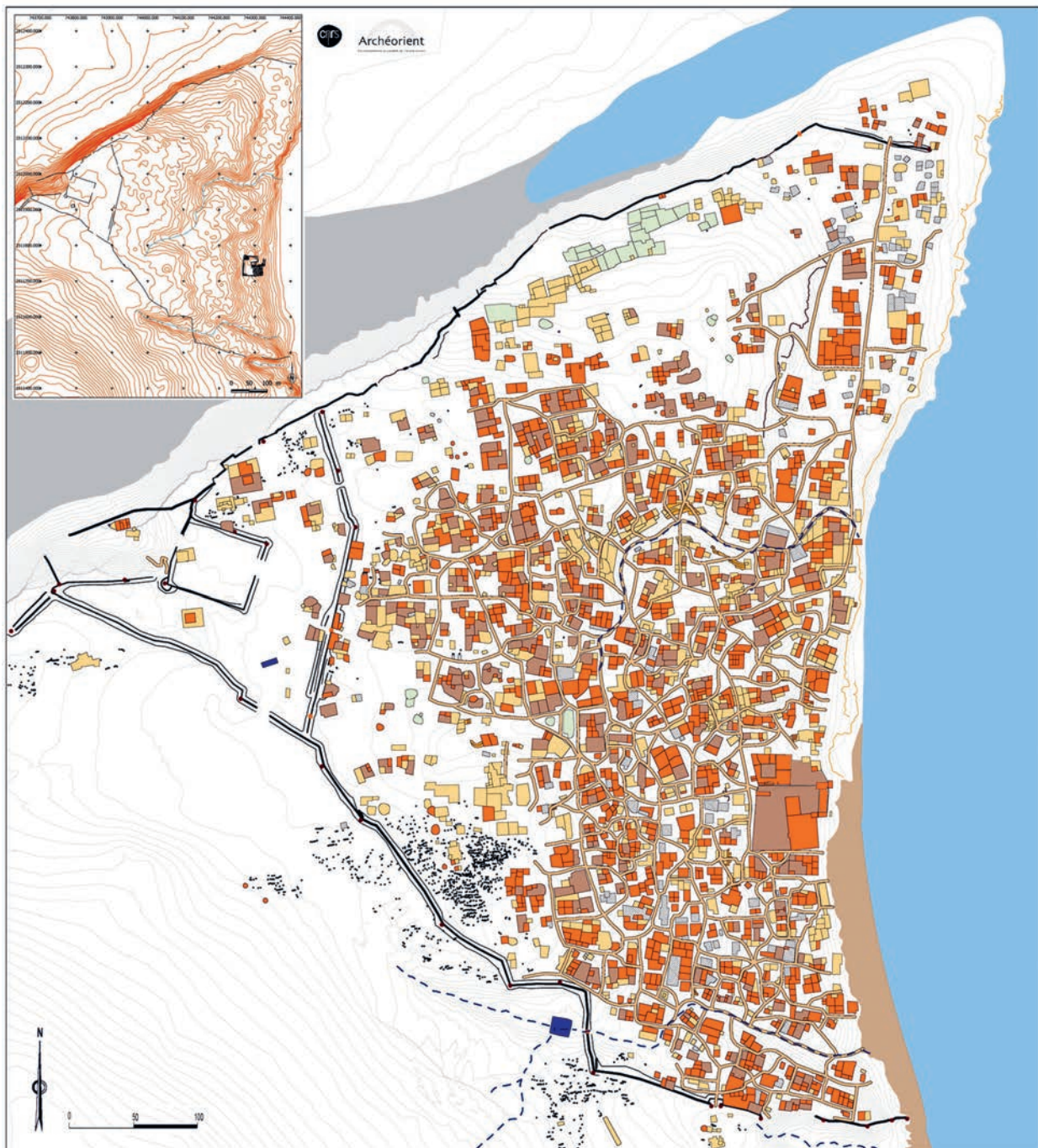
#### *Related studies*

The archaeological material unearthed during excavations has been recorded in dedicated databases and studied by specialists; apart from the



**Figure 1.4. The Cartographic Project: A-B) Differential GPS survey (CNRS-Archéorient); C-D) Drone and pole photogrammetry (Iconem).**



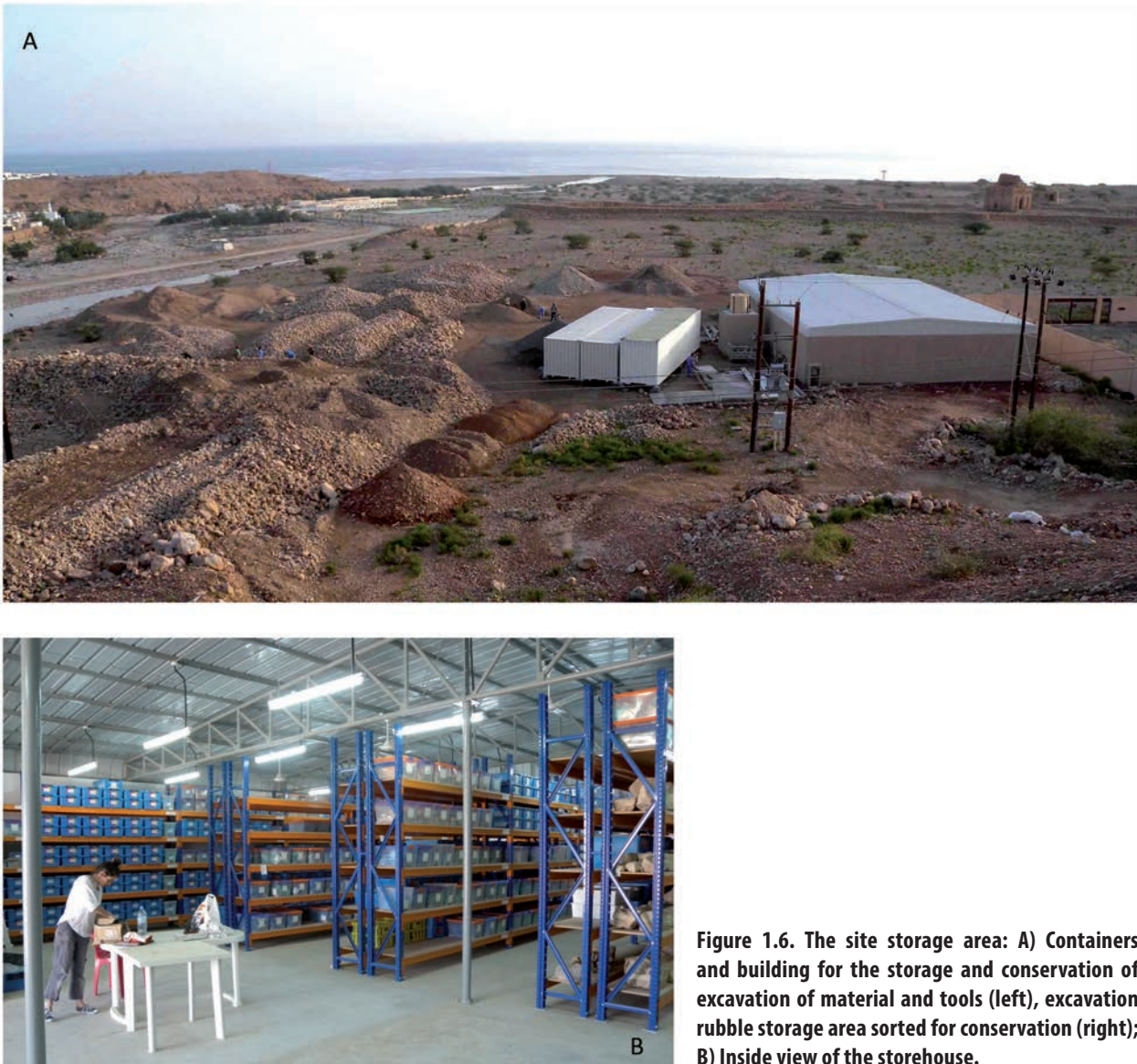


**Figure 1.5. Preliminary map of the site from the 2008-2010 Cartographic Project surveys of the surface (orange: buildings / purple: courtyards / yellow: terraces / green: enclosures / blue: cisterns and *wadis* / black spots: graves).**

exceptional objects preserved in the MHT reserves or the National Museum in Muscat ('Middle Islam' and 'Splendor of Islam' galleries), it is now kept in the store which was built in 2015 by the MHC outside the site, at the foot of the highway, which also includes an office and accommodations (Figure 1.6A-B).

An extensive analysis of the material, and especially, of the huge number of ceramics brought to light during excavations, was carried out all along field work since 2008 (H. Renel, CNRS) in order to build a chrono-typology of this material, an essential tool for the dating and interpretation of the excavated buildings and the chronology of the site (Figure 1.7A-E). The ceramic assemblage of this rather late period





**Figure 1.6. The site storage area: A) Containers and building for the storage and conservation of excavation material and tools (left), excavation rubble storage area sorted for conservation (right); B) Inside view of the storehouse.**

was quite badly known but the discovery and extensive excavation of a pottery workshop of the 14<sup>th</sup> century (Chapter 10) was of a great help to the study of the local ceramic production and trade (Lesguer and Renel 2018). Physico-chemical analyses of sherds were also carried out<sup>3</sup> to help identify the characteristics of this local production (Rougeulle *et al.* 2014; Gianni *et al.* 2020). A preliminary study of the Far Eastern imports was carried out in 2011 by B. Zhao (CNRS-CRCAO, Centre de recherche sur les civilisations de l'Asie orientale), and analyses were also held to search for the exact origin of this material (Simsek *et al.* 2014; Zhao *et al.* 2017).

Organic remains have also been preserved and analysed (Chapter 9).<sup>4</sup> Most of the mammalian bones have been studied (Monchot and Béarez 2016; Monchot and Guintard 2017), as well as the fish fauna from the twin houses B94. Micro-fauna and botanical samples from selected layers in specific buildings, especially the twin houses B94, the jeweller's workshop B39 and the Great Mosque B12, were collected, by sieving and flotation, and studied (Figure 1.7F), as well as wood elements found in masonries (Dabrowski 2019; Dabrowski *et al.* 2015; 2018).





**Figure 1.7. Material registration and studies: A-C) Sorting, washing and drying of excavated material after fieldwork; D) Field data recording; E) Ceramic study; F) Flotation for micro-fauna and botanical sampling.**

Finally, a rather extensive historical study was carried out on historical sources to complete that published by Bhacker and Bhacker (2004) and to help understand the topography and evolution of the town (Rougeulle 2017; see Chapter 2).

### **Qalhat on the UNESCO World Heritage List**

Qalhat had long been renowned as an outstanding archaeological site, a key part of the history of Oman and the Western Indian Ocean during the Middle Ages, and the site was inscribed on the tentative list to UNESCO as early as 1988. But too little was known about the site at that time to claim it being nominated on the World

Heritage List. Besides opening an archaeological park, the main objective of the MHC when launching a large research project in Qalhat in 2007 was to obtain enough information to make this nomination a success. Considering the exceptional results of the QP and QDP, a submission file was prepared in 2016-2017 by an Omani National Committee and Qalhat was finally nominated at the end of June 2018 (Chapter 11).

## Notes to Chapter 1

<sup>1</sup> These first kite photographs of Qalhat were taken by Yves Guichard (CNRS), then a member of the team of the Joint Hadd Project who was working the same 2003 season in the nearby area of Ras al Hadd. Our warmest thanks go to T. Vosmer for providing us with these photos which were of invaluable help during the early stages of the QP.

<sup>2</sup> This grant was made possible thanks to B. Huillard, then Director of the Oman Branch of Total S.A., to whom we owe a lot for his efficient and warm support to the Project.

<sup>3</sup> In the Monaris, previously Ladir, lab of the CNRS/Pierre and Marie Curie University, Paris, under the direction of Ph. Colomban.

<sup>4</sup> In the National Museum for Natural History, Paris, under the direction of M. Tengberg and Ph. Béarez.