Earthen Architecture in Muslim Cultures

Historical and Anthropological Perspectives

Edited by

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Contents

CHAPTER 7

Mud Brick Architecture in Ḥaḍramawt-Yemen under the Quʿaiti and Kathiri Sultanates

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Ḥaḍramawt is a vast, semi-arid region in the South of the Arabian Peninsula, situated between the immense Rubal-Khali desert ("the Empty Quarter") and the Gulf of Aden.[1] Its geology is simple, comprising a vast tabular plateau of tertiary Palaeocene-Eocene limestones, the *jol*, deeply incised, down to Cretaceous sandstone layers, forming valley-oases. The average height of the plateau, above the valley floors, is three hundred meters.

The Yemenite power of Sanaʿa set up these last decades a massive immigration of north-Yemenite Zaïdite populations in an attempt to assimilate a historically Sunni territory. Al-Qaeda found a place in the Arabian Peninsula where it developed between refusal of Shiism and alliances with local tribes proud of their autonomy. We must also remember that the British who controlled the South of Arabia from Aden had tried to bring into conflict the Ḥaḍramawt populations gathered in an "Aden Protectorate" and the components of the "Federation of Southern Arabia". The two most important sultanates, the Quʿaiti Sultanate and the Kathiri Sultanate, of this Protectorate disappeared during 1967, as the other sometimes tiny entities: they possessed a flag and issued numerous emissions of postage stamps. Ḥaḍramawt tried, for a short while, to be independent, with the support of Saudi Arabia that sought an outlet to the Indian Ocean. The creation of South-Yemen (PDRY, the People's Democratic Republic of Yemen) allowed Aden politicians to reunite Southern territories, not without difficulty. During 1990, the general reunification of Yemen was made to the detriment of the South, and especially of Ḥaḍramawt.

Politically autonomous and separate from centres of power, it was the territory of one of the most powerful kingdoms of ancient Arabia, acting as an essential intermediary between the Mediterranean world and the still lesser-known Far East. The kingdom of Ḥaḍramawt, which controlled production of aromatic resins, also guaranteed the commercial traffic in precious items highly appreciated by the Mediterranean world which impacted on every coast of the Indian Ocean.

The trade in locally harvested frankincense and myrrh ensured it scarcely-equalled prosperity and fame, from as early as the middle of the first millennium BC. The centre of this caravan trade was the city of Shabwa, described by such ancient authors as Strabo. Located at the entrance to the wādī Ḥaḍramawt, the old *Sarīrān*, the city controlled all the routes leading towards Gaza, Petra, and Palmyra. The wādī flows from the high plateaus of western Yemen that rise to more than 3500 meters, crossing the desert of Ramlat al-Sabʿatayn underground, following a long course where it takes the name of Wādī Massilah, before flowing into the Indian Ocean. The wide and fertile valley divides the territory of Ḥaḍramawt into two zones. The first, in the North, is inhospitable, on the fringe of the desert; the other, in the South, between the wādī and the ocean, descends steeply towards a narrow coastal plain. Valley bottoms and piedmonts facing the desert were always cultivated and constitute the most important population centres along with the Wādī Ḥaḍramawt itself, facing east, which

1 We do not know exactly the origin of this name. During antiquity, we can find *ḥḍmt* or *ḥdrmwt* in south Arabian languages. In ancient times the name of Ḥaḍramawt seems to be in the Book of *Genesis* (X, 26) or in *Chronicles* (I,20), "*Ḥâṣarmāweth*". We find also the name of these people in Greek (Strabo) and *Atramitae* in Latin (Plinus).

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is the most important oasis with major tributaries such as the Wādīs Dūʿān, ʿAmd and ʿIdīm coming from the south.

Fertile alluvial deposits enabled the establishment of a sedentary population, proud of their values, which knew how to create and maintain large scale irrigation, the development of elaborate architecture and the creation of efficient commercial networks.

The population's tribal structure gave rise to several state entities, often in conflicts, such as, in the beginning of the 19th century, with the Quʿaiti Sultanate, including the city of Shibām, ruled from al-Mukalla and the Kathiri Sultanate, including the town of Tarīm, ruled from Say'ūn (fig. 7.1). As great travellers, the Ḥaḍramis colonized numerous coastal regions, like their eastern neighbours in the present-day Sultanate of Oman. From Zanzibar to Gujarat, Kerala and the Malay Archipelago (Dutch East Indies), they established commercial counters, settled down, and were often involved in political activities, as in Timor and in Brunei. In competition with Chinese traders they made fortunes, from which their country of origin benefited greatly.[2] They often returned home at the end of their career abroad as "old notables", bringing with them all the modernities of the Victorian era, such as equipped bathrooms, automobiles, ventilators as well as fashions and architectural models that transformed the large houses of Tarīm and Say'ūn into "Maharajah's palaces" (fig. 7.2), as illustrated by the palaces of the al-Kāf family (fig. 7.3).[3]

A city cannot be separated from its rural context and territories (Figure 7.4). Likewise, agriculture cannot be separated from the wādīs' flood management nor architecture from building construction techniques.

"Each irrigation network is associated with a house," wrote Pierre Gentelle about the agricultural soils of the lowlands around Ramlat al-Sabʿatayn.[4] Conversely, there is no construction without an irrigation system. The clay of raw bricks, or rather sunbaked bricks, comes from the muddy fields deposits. With each flood a very thin layer of fertile earth covers plots of land. Gentelle added: "It is the water that makes the field". This earth is inexpensive and processing it into a construction material is easy to do. Inconveniences are the duration of the manufacturing and the number of bricks that need to be produced.[5] A great advantage is close proximity to raw material and the manufacturing workshops usually associated with construction sites.

To construct buildings, the Ḥaḍrami mastered techniques necessary for using this easy available material that, nevertheless, had a limited time span and, therefore, required periodic renewal.[6] They developed an exceptional architectural type—the tower-house, found

2 "Of all parts of the Arabian Peninsula, Ḥaḍramawt is preeminently the land of emigration. In Dutch East Indias they have even, in earlier times, succeeded in founding sultanates (e.g. Siak, Pontianak), but now they content themselves with trades and money transactions. Some of them, having become wealthy, return to their own country, but others prefer to enjoy, away from the disturbances of Ḥaḍramawt, the pleasures that are there unattainable." van der Meulen *et al.,* VII.

3 On the same geographical territory, both sultanates are always in concurrence. They sit face to face. The border of the Quʿaiti territory is a quarter of an hour's walk from Shibam. Here is a custom-house, a white Kathiri military post (fig 4), shows an impassable line only after payment of an important toll. Van der Meulen and von Wissmann wrote also apropos of wādī Dūʿān: "…to the right in the far distance the lies the village of Ḥôra with a great castle and a watch tower on a hill. It is a small Quʿaiti island in the midst of a Kathiri sea". van der Meulen *et al.,* 88.

4 "…the inhabited house characterizes the network of irrigation… It disappears, irrigation stops and harvest dies, the field dries out and the canal disappears. there is only water which flows, dehumanized" (Gentelle, *Traces d'eau: un géographe chez les archéologues*).

5 From the highest Antiquity, the duration of manufacturing poses problems. Vitruvius and other authors insist on a specific duration of time bricks require to be made and dry.

6 Regularly, approximately every hundred and fifty years, inhabitants leave their house and let it fall in to ruin. Then they reconstruct a house of the same type in the same location.

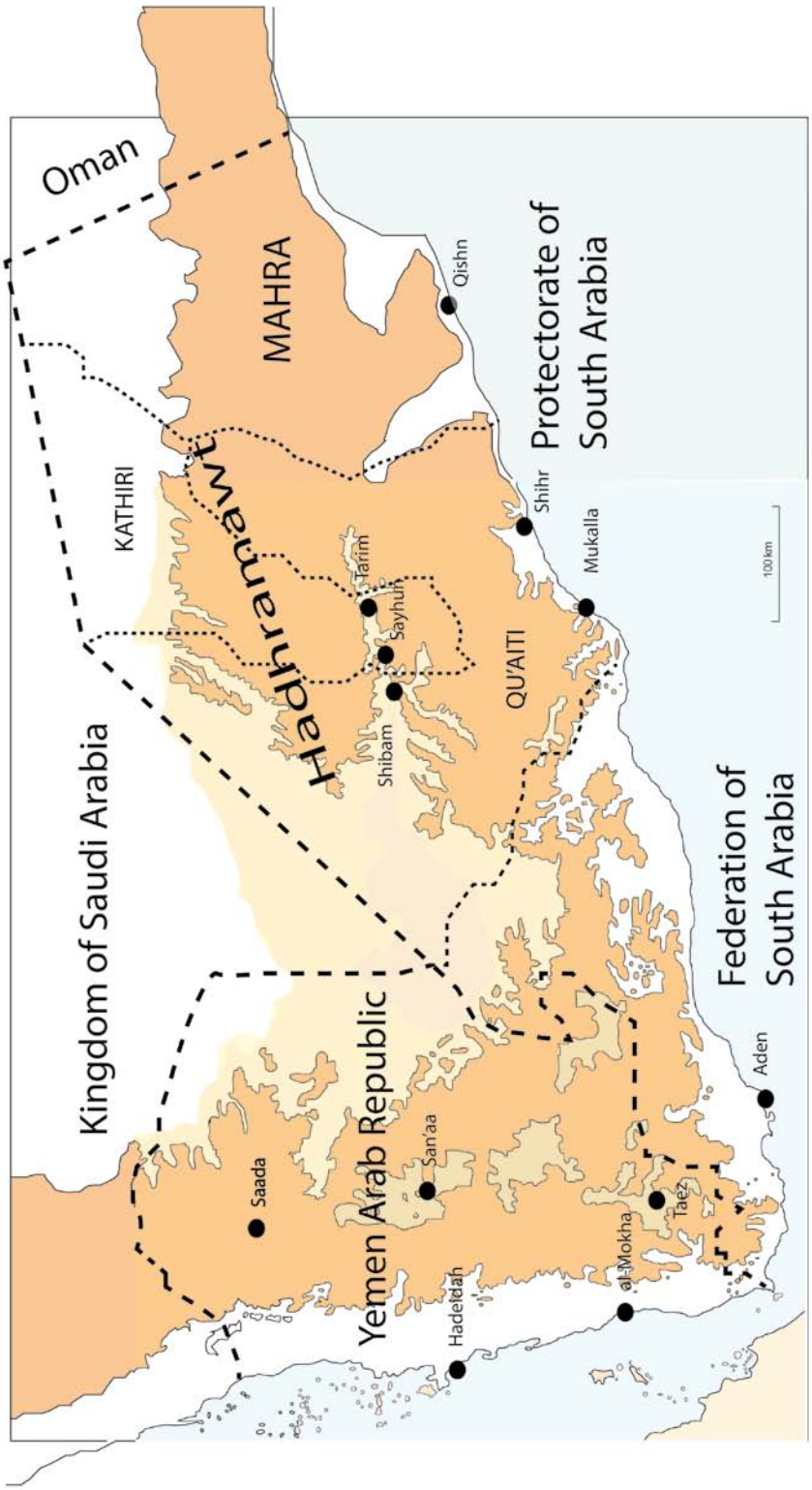

FIGURE 7.1 *Map of Southern Arabia during the two Sultanates*
CREDITS: CHRISTIAN DARLES.

FIGURE 7.2 *Palace of the al-Kāf family*
CREDITS: CHRISTIAN DARLES.

throughout the whole of Southern Arabia, except for the Red Sea coast and the Indian Ocean (fig. 7.5 and 7.6).

The origin of this technique dates back to Antiquity. In Ḥaḍramawt, several ancient sites studied by archaeologists have provided information on techniques used in mud-brick construction. One finds this material used for building, and also for the construction of floors. The Institute of Fine Arts of New York University excavated at Jujah in the valley of Wādī Ḥaḍramawt for two brief seasons during 1994 and 1995 (Shabwa-Mission Archéologique Française au Sud-Yémen, 1974–2002), and the Russian Archeological Mission in Ḥaḍramawt was active at Raybūn, during 1980–1998. The site of Jujah revealed five levels of occupation. The oldest, a cultic building, was built entirely from moulded mud-brick. At Shabwa, a deep sounding was excavated in 2000 and 2002 that ranges from the 16th century BC to the 5th century AD. The earliest periods are characterized by domestic buildings constructed primarily of mud-brick. During this period, irregular clumps of not entirely mud were absent, excluded, especially from enclosed walls and floors. The fortification dating from the latter half of the first millennium BC comprises a large mud-brick structure faced with finely worked limestone. At Shabwa, for the first time, a composite architecture was recorded, comprising a wooden frame with mud-brick fill. At Raybūn, a Russian archaeologist studied several buildings constructed in this manner. Between the vertical elements of the wooden frame, the bricks were protected by a facing made from limestone slabs. All these sites indicate that mud-brick was used only above a basement or foundation. At Tamna further to the west, French and Italian archaeologists found a similar style of architecture, built on a foundation of granite.

Ḥaḍrami towerhouses were connected with the model of the fortified farmhouse (fig. 7.7), which shelter stored produces and animals in the lower levels, less exposed to the outside. Intermediate

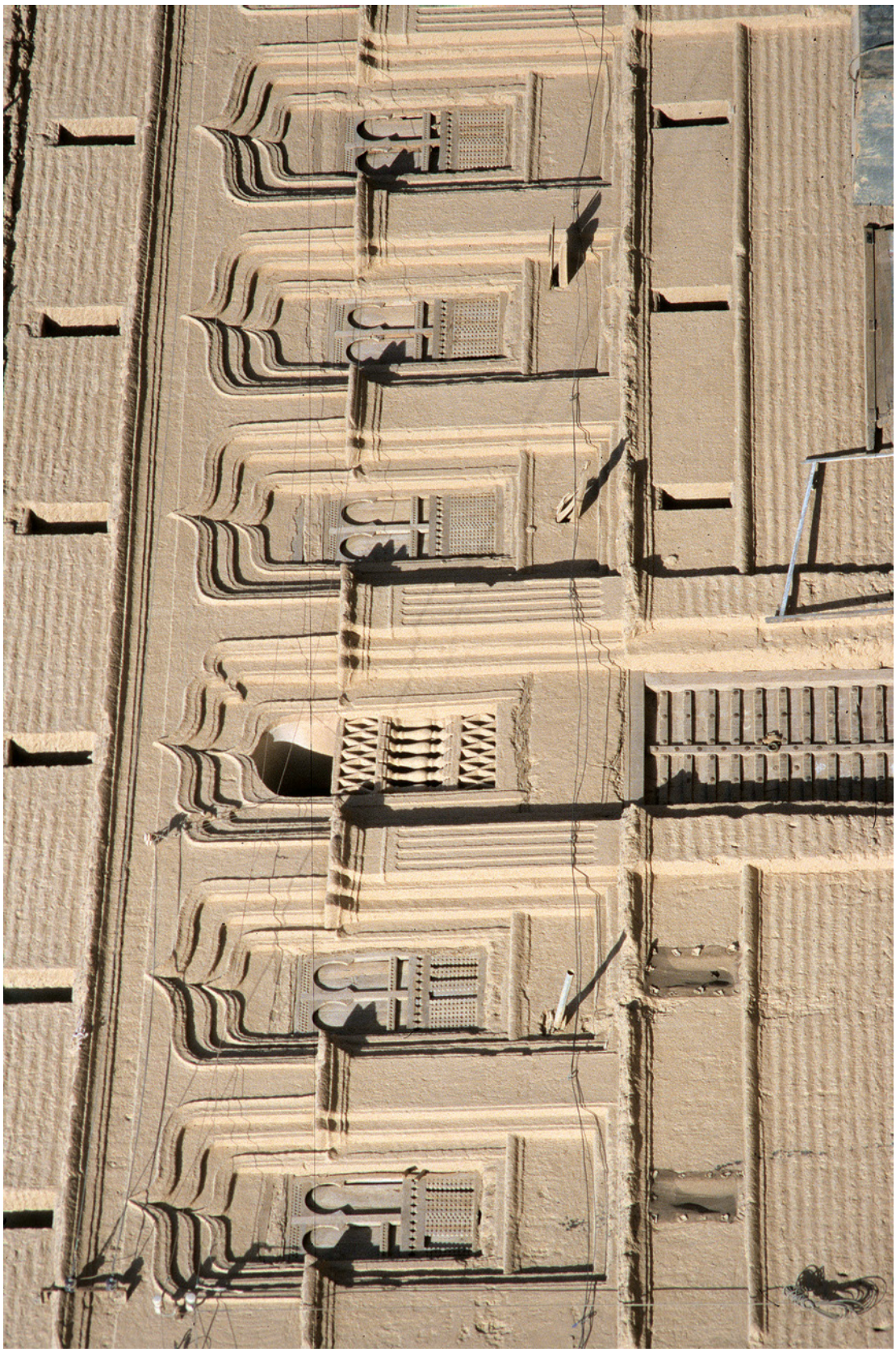

FIGURE 7.3 *Detail of one of the palaces of the al-Kāf family in Tarim*
CREDITS: CHRISTIAN DARLES.

FIGURE 7.4 *Custom house built by the Kathiri*
CREDITS: CHRISTIAN DARLES.

floors are reserved for residential areas while the upper level's inhabited terraces and lounges include the "mafradj", dedicated to the reception and the social life of the patriarch and his guests. This house, inhabited by one family, is autonomous. It is endowed with four decorated *façades* with appropriately placed windows when it stands isolated, and limits its openings, in a dense urban context, because of neighbouring buildings. There are no adjacent walls, so that when an owner buys a contiguous house, it is necessary to open up walls and establish interconnected floors.[7]

While this vertical construction is sometimes massive, most of the time high-rise and slender, it is strictly built with architectural *façades* whose arrangement and order of openings correspond as much to the uses of the rooms as to the strictness of the elevations. It is built with mud from local silts and takes climatic constraints into account, particularly those associated with monsoon rains that are often violent and can damage the moulded or modelled elements, making it necessary to protect them. Heaps of abandoned surplus bricks, melt in the rains, and after a few seasons transform again into building material.

During their history, the inhabitants of South Arabia learned how to use the earth/mud in numerous ways. According to regional and local availability, the Yemeni tower-house was built in mud, usually moulded or modelled bricks, baked or simply dried in the sun. In Saʿdah or in Mā'rib

7 Breton *et al.,* "Les maisons-tours dans l'Antiquité".

FIGURE 7.5 *Tower house of a rich family in Shibam*
CREDITS: CHRISTIAN DARLES.

as well as in Rawdah (north of Sanaʿa), builders always use the *zabour*. Zabour ("bauge") is made with pisés of clay. Sometimes a composite architecture combines several building techniques as at Māʾrib, not far from Ḥaḍramawt, where mud brick upper floors overlap lower ones built in stones, or in the wādī Bayhan or at Sanaʿa where raw brick is used over one or several levels constructed with volcanic stones or baked bricks.

Fertile silt from irrigated agricultural land supplies the earth for making mud. Sedentary inhabitants mastered the flood waters, which transport a large quantity of alluviums that feed fields while contributing to their raising. The surplus of earth from fields constitutes a homogeneous and finely sorted construction material. Since Antiquity, man built houses using the fertile earth from fields without conflict between farming and building. The only thing necessary is the transport to construction sites, by means of small donkeys, of

FIGURE 7.6 *Façade of Shibam above the* Wādi *Hadhramawt*
CREDITS: CHRISTIAN DARLES.

dozens of baskets filled with this product that has become building material.

From ancient times until today, the use of raw bricks continues without notable changes in the manufacturing processes and implementation.[8]

The earth is usually collected near the place where it will be transformed into building material. An open area is cleared of unwanted debris and the brickyard is organized. When the construction site changes location, the brickyard moves according to needs. Earth is heaped in a first location, straw is stacked nearby and some old cans are filled with water. If a water well is distant, donkeys are used to carry goatskin containers. The place where the mixture is made remains the same until the time of a first manufacturing of bricks. Bricks being moulded flat, they occupy a large surface that is sanded beforehand (fig. 7.8). When this surface is too big, the mixing area is moved in order to bring it closer to the working place.

Once trampled and mixed by one or two labourers, with additions such as grass straw, two workers place the construction earth on a small stretcher and bring it to the place indicated by a worker who moulds it and is responsible for the construction site (fig. 7.9). They immediately put it down by his

8 Damluji, *The Architecture of Yemen: From Yafi to Hadramut*.

FIGURE 7.7 *A fortified farmhouse in the valley between Shibam and Seyhun*
CREDITS: CHRISTIAN DARLES.

side, generally to the right (fig. 7.10). The earth is hastily arranged into two chunks by a worker who must be able to measure the quantity and the exact location of the mixture. The site manager puts a double frame on the prepared chunks and moistens his hands. With a sure circular gesture, he equalizes the mixture so that it rests against the internal walls of the frame. He smoothes the convex top by marking some concentric traces with his hands. He quickly removes both bricks from the mould and repeats the operation. The manufacturing requires five people to whom must be added the drivers of the donkeys transporting earth, water and straw and who, at appropriate times, change the place of the sun-baked bricks in the storage area.[9]

As a rule, drying takes place in the shade to avoid cracking. Vitruvius, during the first century BC, recommended it be allowed to continue for two years, starting from spring or autumn.[10] In reality, the making of bricks is much faster in South Arabia (fig. 7.11), where drying of the moulded bricks does not last more than three weeks. Bricks dry flat at first (from six hours to three days), then are set on edge (from five to 15 days), then arranged vertically, in fishbone array and moved repeatedly to dry uniformly. Depending on progress at the construction site they can be used immediately afterwards or stored. In Ḥaḍramawt, nowadays they can be stored for several months (fig. 7.12 and 7.13).

The shape of moulded bricks differs slightly according to workshop. They can have specific dimensions according to destination or construction site. The shape can vary from square to elongate rectangle and the thicknesses are variable. In the same building, precise shapes can

9 Aurenche, *Dictionnaire Illustré Multilingue de l'Architecture du Proche-Orient Ancient;*Aurenche, *La maison orientale, l'architecture du Proche-Orient ancien des origines au milieu du quatrième millénaire*, 66; Guest-Papamanoli, "L'emploi de la brique crue dans le domaine égéen à l'époque néolithique et à l'Age du Bronze", 9, note 38.

10 Vitruvius, *De Architectura*, II: 3, 2.

FIGURE 7.8 *Worker from Shibam who is treading the earth*
CREDITS: CHRISTIAN DARLES.

differ, indicating that the origins are multiple and often implies possible re-use.

In Ḥaḍramawt, the generally plano-convex bricks are more than 40 cm in length by 25–28 cm in width and 5 cms in thickness while at Sanaʿa the dimensions are 25 cms by 18 cms and 10 cms in thickness. On each horizontal foundation, builders put a layer of earth mixed with grass straw intended to receive the following row. The bonding mortar generally comprises diluted clay. Used in

FIGURE 7.9 *Earth is mixed with straw*
CREDITS: CHRISTIAN DARLES.

FIGURE 7.10 *Mud bricks molds*
CREDITS: CHRISTIAN DARLES.

plastering, it fills the gaps between bricks as they are laid.[11]

The mud brick construction in the city of Shibām deserves to be described in detail, because it is representative of a building tradition that is common in this part of the world (fig. 7.14).

The act of building must fulfill several requirements and is marked with numerous rites. Horns of ibex (a rare and endangered animal) are often embedded in the external angles of the buildings

11 Breton *et al.*, "Shibâm".

FIGURE 7.11 *Bricks are molded flat and occupy a large surface*
CREDITS: CHRISTIAN DARLES.

FIGURE 7.12
Drying bricks arranged vertically for better ventilation
CREDITS: CHRISTIAN DARLES.

to ward off evil spirits and assure the household's well-being. The building techniques are (still today) maintained by skilled masters. For example at Shibām, tower-houses often replace a previous building that was voluntarily abandoned and collapsed because of structural disorders. Then, once all the pieces of wood are collected, from the floors, doors, windows and ceilings, the earth from the building is evacuated then mixed to some "fresh" silt to manufacture bricks.

At the beginning of the 20th century, the council agreed to limit building height to 35 m. The city thus possesses a scrupulously respected *velum* and buildings, by adapting themselves to the topography of the ground within the city, possess from five to eight levels. Terraces bordering reception rooms constitute important open spaces with no ceiling other than the sky above. They possess large windows and small openings allowing a view of the street activity and main door. These terraces are the archetypal places of family life, for women and young children. The outer ring of buildings that lead to the peripheral rampart wall of the city of Shibām form a second defensive fortification. The

FIGURE 7.13 *Storage of mud bricks before building construction*
CREDITS: CHRISTIAN DARLES.

FIGURE 7.14 *View of the southwest corner of the City of Shibam with a new destroyed house and the curtain wall* CREDITS: CHRISTIAN DARLES.

introverted city turns its back on its territory towards which it opens only by a single triumphal gate. The city only shows the rear *façade* of its houses.[12]

The walls of the buildings are constructed on earlier ruins and this requires precise skills. The foundations are built in trenches on a rocky surface, vary between 0,90 m and 1,10 m wide, consist of limestone blocks cemented with lime; bricks of raw earth are set on edge to cover this foundation rises slightly above ground level to form a base for the superstructure of bricks that rises more than thirty meters. This complex foundation does not exceed two meters high.[13]

The masonry of the walls is organized according to a rhythm of five courses, separated by mud mortar of the same nature as that of the bricks, so that the thickness of the joints is close to that of the bricks (fig. 7.15). Particular care is given to external angles and to connections between *façades* and supporting walls; only the supervisor (the *mua' allim*) who manages the team of workers (the *khaddamin*) can deal with the construction of these crucial parts.

Must used for plastering, fills the joints between bricks as they are being laid. Use of this kind of bricks, in the past as well as today, requires protection against humidity, rare run off waters, spray from roof spouts that splashes on the ground, and erosion caused by wind and ground water fluctuations (fig. 7.16 and 7.17).[14]

This filler is often covered by a layer of fat lime-based "*ramad*", which waterproof the upper parts and basements affected by water run off from roves (fig. 7.18).

Partition brick walls include a header and a stretcher (from 65 to 70 cm approximately) while the width of *façade* walls corresponds to three stretcher bricks *panneresse* or two heading-bonded bricks, 85 cms on average.

Every five courses, branches or timbles enable the clamping of the walls (fig. 7.19). The lintels have been rehabilitated, so that the inscriptions engraved on their faces allow dating of the house's most recent reconstructions. Reused wooden fittings were carefully taken to pieces, to be installed

12 Breton *et al.*, "Shibâm and the Wâdî Hadramaut".

13 Margueron, "Notes d'archéologie et d'architecture orientales".

14 *Ibid.*

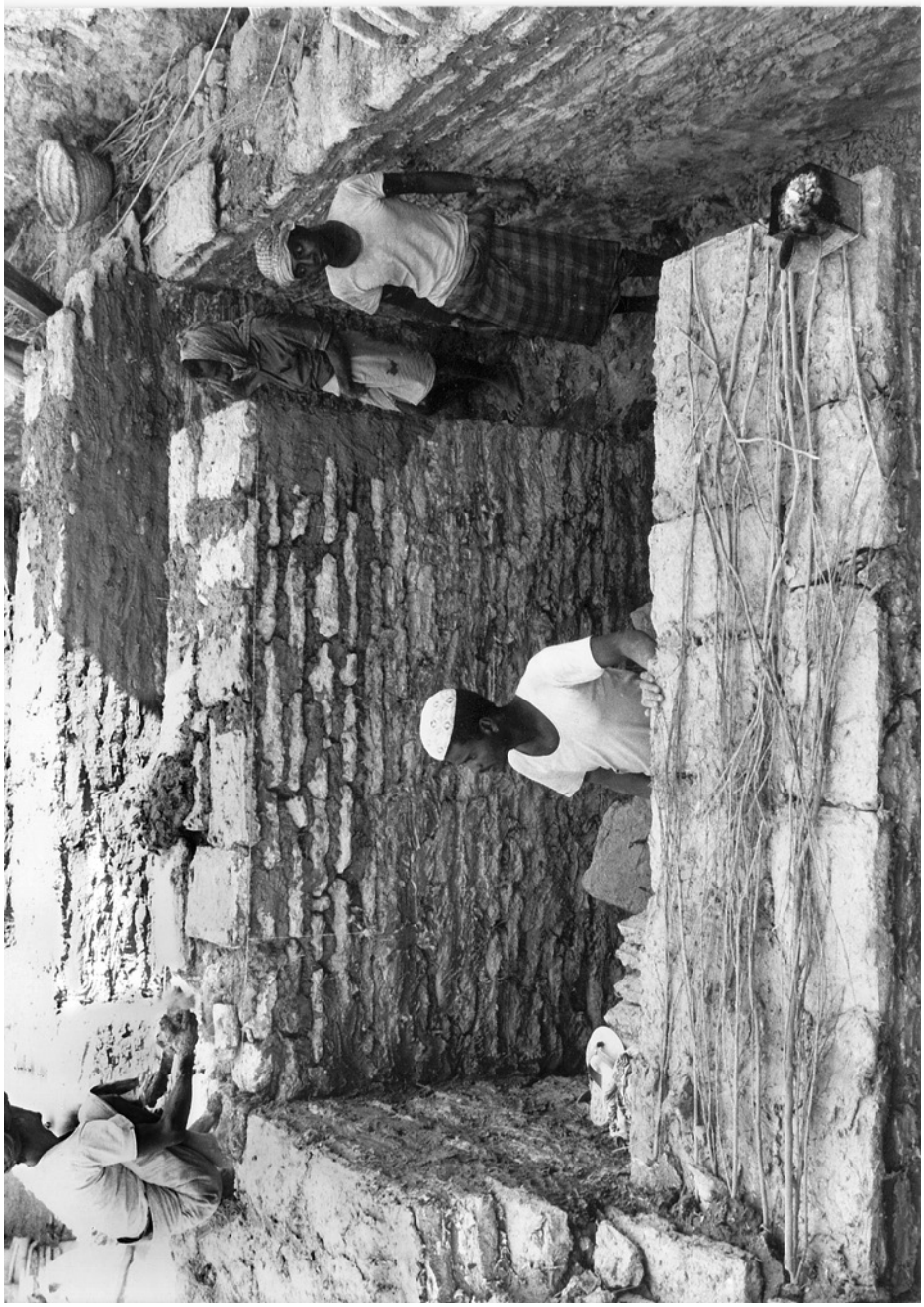

FIGURE 7.15 *Between every five courses of mud brick construction, the* Mua'llim *insert cut branches as a chaining*
CREDITS: CHRISTIAN DARLES.

FIGURE 7.16 *Plastering work of the* façade *of the tower houses*
CREDITS: CHRISTIAN DARLES.

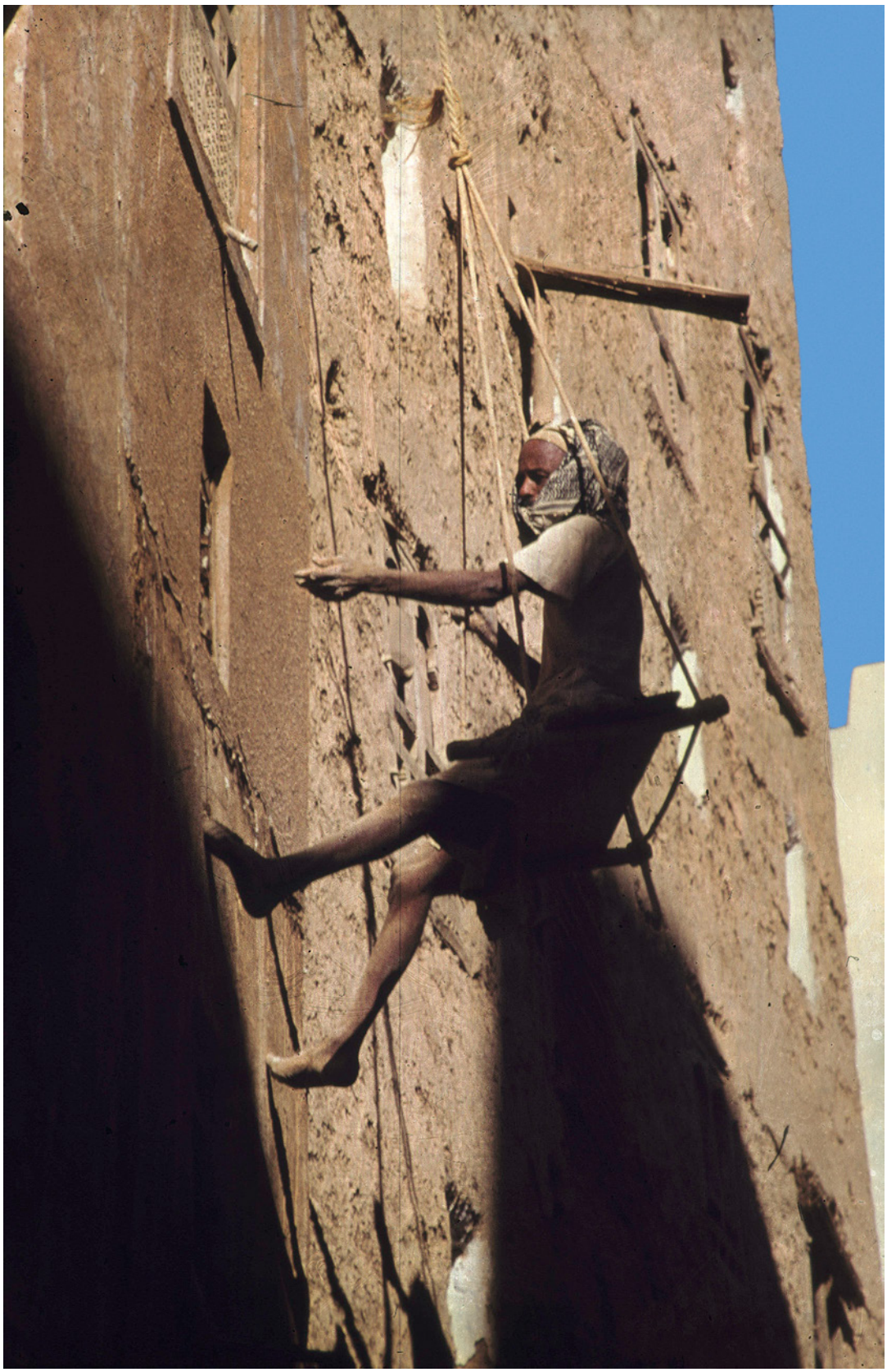

FIGURE 7.17 *Often suspended the worker is alone*
CREDITS: CHRISTIAN DARLES.

FIGURE 7.18 *Lime-based* Ramad *for waterproofing the upper parts and basements of the houses*
CREDITS: CHRISTIAN DARLES.

FIGURE 7.19 *Branches and timbles enable the clamping of the walls*
CREDITS: CHRISTIAN DARLES.

later, their location being temporarily walled up during the construction period. Floors are made of earth on a frame of beams and palm-tree wood joists topped with a layer of reeds. Internal walls, and floors as well, are covered by a thick filler with fat lime. This carefully polished filler covers the walls of the niches and shelves built with bricks arranged in console.

Lower levels with thick and close walls and very narrow rooms are common. In the upper floors, wooden posts increase the surface area of living rooms without increasing the bearing of horizontal timbers. This composite architecture combines wooden linear vertical carrier elements with raw brick-built walls, and allows the creation of bigger rooms as well as a lightening of the carrier structure. The walls of upper floors do not exceed 55 cms in thickness.

After the workers sacrifice an animal (most often a goat), the walls are coated for the last time and wooden fittings are installed. Then, only after paying the craftsmen, the owner can enter his house.

And so they built at Shibām in the Quʿaiti Sultanate and also at Sayʾūn in the Kathiri sultanate. At Sayʾūn however, the buildings are lower. At Tarīm, east of Sayʾūn, the great number of large, square palaces is noticeable (fig. 7.20). They are not ochre and white as in Sayʾūn and Shibām, but of all manner of striking colours. One of them is blue, yellow and pink and is, consequently, the most conspicuous: "a very high minaret (150 feet), not

FIGURE 7.20 *Indonesian palace of Tarim built by a rich Yemeni merchant in southeast Asia*
CREDITS: CHRISTIAN DARLES.

round but square in shape, and also plastered in a shade of blue, is a thing by itself. Tarīm is a town of many rich men: one can see that even from a distance".[15] The most beautiful house in all Tarīm was the one of Sayyid ʿUmar bin Shaikh al-Kāf, with a swimming pool. The outside was painted deep blue, and the stately rows of tall windows are bordered with a design in yellow. We have found use of pink and green. The style was more Indian than Ḥaḍrami.[16] These great palaces have a character quite of their own that one does not see in the other towns of the valley. They are massive, square building with a few extensions on the roofs, and decorative designs on the top of the walls or on the parapets.

In Ḥaḍramawt, since ancient times until today sun-dried mud-brick remains the dominant building material for an architecture that, at Shibām, for example, can reach thirty meters in height. Since the disappearance of the sultanates and the emergence of the Republic, during 1967, despite a notable conservation, the people of the Wādī Ḥaḍramawt combine mud with stone. It is only with the building of roads and the arrival of heavy vehicles that one sees the use of reinforced concrete with its preformed blocks and iron frames. More easy to put in place and less expansive than mud-brick, this new material has not entirely replaced the use of the more expansive mud brick.

15 van der Meulen *et al.*, *Ḥaḍramaut, Some of Its Mysteries Unveiled*, 131.

16 *Ibid.*, 135.

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