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► To cite this version:

Jean-François Breton. SALT ROUTES IN SOUTH ARABIA AND AROUND THE RED SEA. George Hatke and Ronald Ruzicka. South Arabian Long-Distance Trade in Antiquity, Cambridge Scholars Publishing, pp.154-174, 2021, 1-5275-6456-8. hal-03942864

HAL Id: hal-03942864

<https://bnf.hal.science/hal-03942864>

Submitted on 17 Jan 2023

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CHAPTER FIVE

SALT ROUTES IN SOUTH ARABIA AND AROUND THE RED SEA

JEAN-FRANCOIS BRETON¹

Abstract

One of the main salt basins in South Arabia is located in the southern part of Yemen, along the edges of Ramlat as-Sab‘atayn. This basin, some 600 km long and 100 km wide, shows diapiric walls orientated northwest-southeast, from the Indian Ocean to the Jawf. The salt-mines follow a long line west of Ḥaḍramawt cliffs (*Jawl*) and north of Jabal al-Nisiyīn. Salt-mines are sometimes located at the tail of main wādīs, such as Wādīs ‘Irmā/‘Atf, Jirdān, Ḥammām and Bayḥān. Salt was probably a small-scale production, feeding a local and regional trade in antiquity. However, documents are too few in number to evaluate its value. Some inscribed palm sticks mention few quantities of salt, but they do not provide any indication of patterns of trade.

In northern Tihāma, salt-mines around as-Salīf and Jabal al-Milḥ diapir lying approximately 12 km inland from the Red Sea shoreline, are known from medieval period.

In the Afar depression on the western side of the Red Sea, salt traded to the high plateau was used as a form of currency.

1: The geographical context of Ramlat as-Sab‘atayn

The predominantly northwest-southeast oriented Mesozoic (250 to 66 million years BP) basins of mainland Yemen are part of the much larger basin system in Northeast Africa and the Arabian Peninsula.²

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² “The Late Jurassic rifting between east Africa and west India also caused extensional tectonics in Yemen (but notably without rift-related volcanism), and sediments began to fill Mesozoic grabens thus developed, including the Siḥam–Ad-Dalī’, Sab‘atayn, Say’un–Masilah, Balhaf and Jiza’–Qamar basins” (As-Saruri 2010: 521).

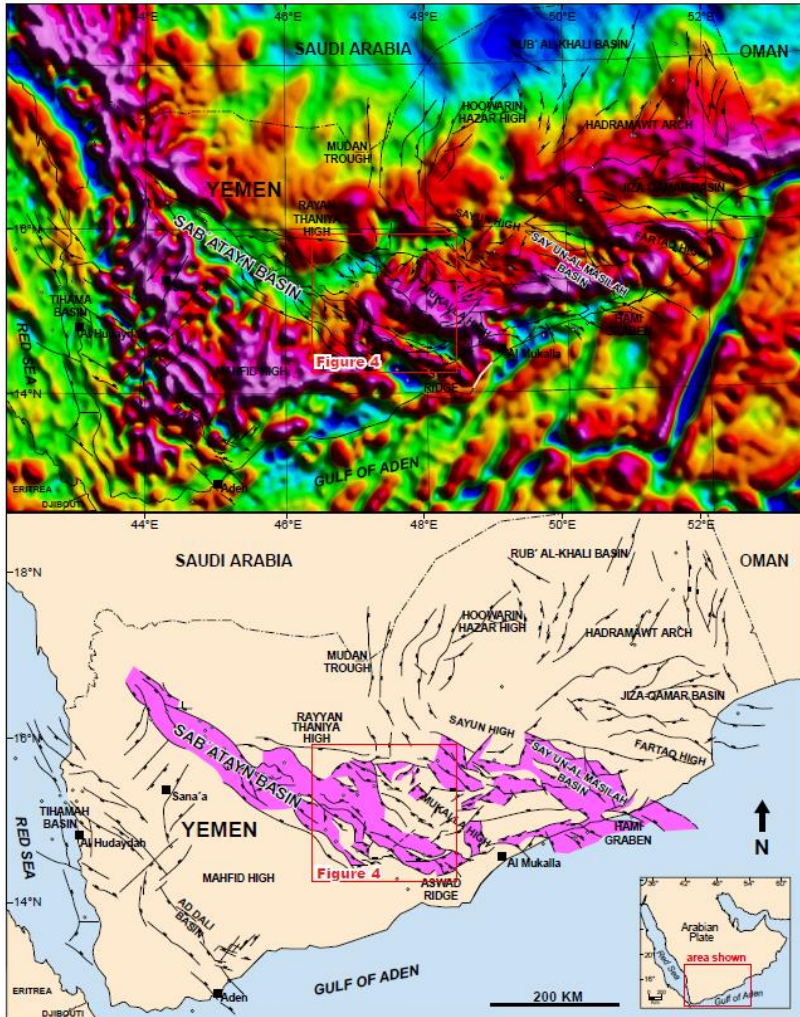


Fig. 5-1: Location of the Saba'tayn Basin in southeastern Yemen, in the southern part of the Arabian Peninsula. Major Mesozoic faults are shown in black and the Late Jurassic rift grabens highlighted in magenta (Gabor *et al.* 2017, fig.2)

The northwest-southeast oriented Saba'tayn Basin is one of the aborted Jurassic rift basins located in the southern part of the Arabian Peninsula, with a length of about 600 km and average width of about 100 km. The important

difference between the Sabaʿtayn Basin and all these other basins (Sudan, Ethiopia, Somaliland and Somalia) is the presence of salt in the early post-rift basin fill.³

In southeastern Yemen, the eastern graben, the “Hami Graben”, forms the Sayʿūn-Masīlah Basin, some 200 km northeast of Mukallā. The western graben, the Sabaʿtayn Basin, joins the bay of Biʿr ʿAlī with the Jawf; its eastern part follows a line from Ḥabbān to Shabwa and the Thaniyah Ridge, as its western part dominates the Jawf valley (Fig. 5-1). The Ramlat as-Sabaʿtayn Basin is a major hydrocarbon region in eastern and central Yemen, where the first commercial discovery was made in 1984.⁴

Regional setting, stratigraphy and structure of the Sabaʿtayn Basin

This study focuses on salt tectonics in the central segment of the Sabaʿtayn Basin. The salt basin is bound by a ca. 80 km long east/northeast-west/southwest oriented basement fault zone on the north and an almost equally long east-west oriented basement fault zone in the south.

“To the West, there is a connection to the deeper Māʿrib segment of the Sabʿatayn Basin.⁵ Similarly the salt seems to be unconfined to the SE. The salt basin in the study area is segmented into smaller sub-basins which are set up by underlying large normal faults with kilometer-scale offsets at the level of the basement. The NW-SE to WNW-ESE trending diapiric salt walls appear to follow the underlying structural grain, like in most segments of the Shabwah segments of the Sabʿatayn Basin.”⁶ Diapirs and salt-mines are mainly located in the eastern and central part of the Sabaʿtayn Basin.

In antiquity, most of the South Arabian kingdoms were associated with salt-mines (Fig. 5-2). Shabwa had salt-mines all around. The ancient cities of Barīra and of al-Bīna are connected with the salt-mines at ʿAyadīm, at the tail of Wādī Jirdān. To the north of Wādīs Ḍuraʿ and ʿAbadān, some small-scale salt-mines are located at Najd al-Milh. The Qatabān kingdom owned or controlled the ʿAyadīm salt-mine, some 45 km northwest of Tamnaʿ, while the kingdom of Sabaʿ controlled as-Safīr salt-mines in the Wādī Abrad. But, as far as we know, no state in the Jawf Valley has close-by salt-mines and thus would have to import it from elsewhere.

³ Tari 2016: 1-2.

⁴ As-Saruri and Sorkhabi 2010: 525; Tari 2017: 121 .

⁵ As-Safīr salt-mines northeast of Maʿrib.

⁶ Tari 2017: 139.

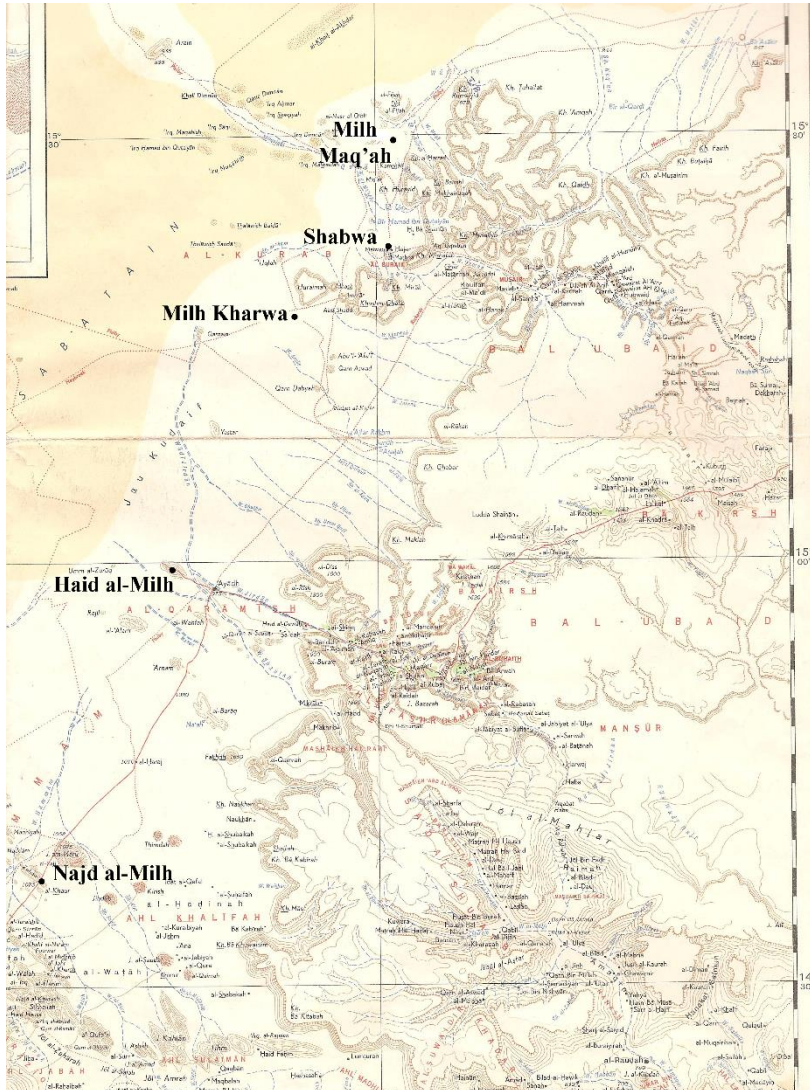


Fig. 5-2: Map of salt-mines around Shabwa (map background: H. von Wissman, Southern Arabia, 1957).

2: The Sab‘atayn basin salt mines

2.1: Salt mines in and around Shabwa

A number of salt-mines are to be found all around Shabwa, to the north and to the south.

In Shabwa itself, the salt dome has lift fields up to 50 m high, forming a triangle of hills, covered with wādī pebbles⁷. Three mines exist inside the flat triangle named as-Sakbha.

The first is Milḥ Mughaira, some 15 m by 15 m wide and 10 m deep. The second is Milḥ Al-Rashīd, some 40 m long by 12 m in width, and 5 m in depth (in 1950). Due to non-stop work, the depth is around 10 m, and some tunnels are much deeper⁸ (Fig. 5-3). The third mine is Milḥ Rabī‘a. According to Philby, “[there is a] third salt-mine called Milḥ Rabī‘a, which is no longer worked”,⁹ situated in a fold of the “citadel” ridge a little away to the west of the temple”.¹⁰ The three salt-mines were probably exploited throughout antiquity, the Middle Ages and modern times.



Fig. 5-3: Milḥ al-Rashīd salt-mine at Shabwa (cliché J.-F. Breton 1982)

⁷ Breton 1992: 61-3.

⁸ Philby wrote that the salt mine was 100 ft long (30.5 m), 40 ft wide (12.20 m) and 15 m (4.6 m) deep (Philby 1939: 114). That depth is nowadays much more important.

⁹ Philby 1936: 115.

¹⁰ *ibid.*: 91.

In 2000, many samples of salt from Shabwa were sent to the laboratory of Géochimie Bioorganique, UMR 7509. The results of analysis samples are as follows:¹¹ The salt is impregnated with bitumen at a rate of 14000-18000 parts per million (extracted with dichlormethane) and 15% to 30% with oil. Existing traces of oil have to be looked for in the salt-mines surrounding Shabwa. The rather diffuse asphalt could not be used in antiquity because it is too closely associated with salt. Indeed, there is no documentation on bitumen use in Shabwa's material.



Fig. 5-4: Milh Maqah hills (by courtesy of G. Tari)



Fig. 5-5: Altered, gypsum-dominated rocks exposed on the surface along the perimeter of the Milh Kharwah salt diapir, interpreted as altered caprock. The view is to the southeast. Note the darker colors of the outcropping formations on the right-hand side of the photo, in the core of the diapir (Tari et al. 2016: fig. 7).

¹¹ Analysis by Dr. Jacques Connan, Laboratoire de Géochimie Bioorganique, UMR 7509. CNRS. E. C. P. M.-Université Louis Pasteur-Strasbourg.

Some salt mines are recorded all around Shabwa but are no longer worked: Milḥ Maqah, 15 km north of Shabwa (Fig. 5-4); and Milḥ Kharwah, 15 km south west of Shabwa (Fig. 5-5). The latter mine is located in the center of salt diapir exposed on the surface just east of the Ḥabbān Field area.

“The internal complexity of the Milḥ Kharwah salt diapir is well-illustrated by a high-resolution satellite image. The diapir has a whitish rim where the Upper Jurassic salt was transformed mostly to a mixture of gypsum and anhydrite on the surface. The internal part of the diapir (dark colors) has halite, bituminous marls, shales and possibly “stringers” of other, non-evaporitic lithologies such as limestones”.¹²

The salt-mines of ‘Ayādīm, at the tail of Wādī Jirdān, some 5 km northeast of the village of ‘Ayādh and some 15 km northwest of Barīra,¹³ is still worked (Fig. 5-6 and 5-7).



Fig. 5-6: Salt mine at ‘Ayādh (cliché J.-F. Breton, 1980)

It is possible to draw up a map of salt routes around Shabwa. From these three mines, salt (along with other items, such as incense, etc.) was transported to Shabwa. From there, it was transported in three main directions:

¹² Tari et al. 2016: 6.

¹³ Steinmetz 2000. Detailed description by Philby 1939: 329-30.

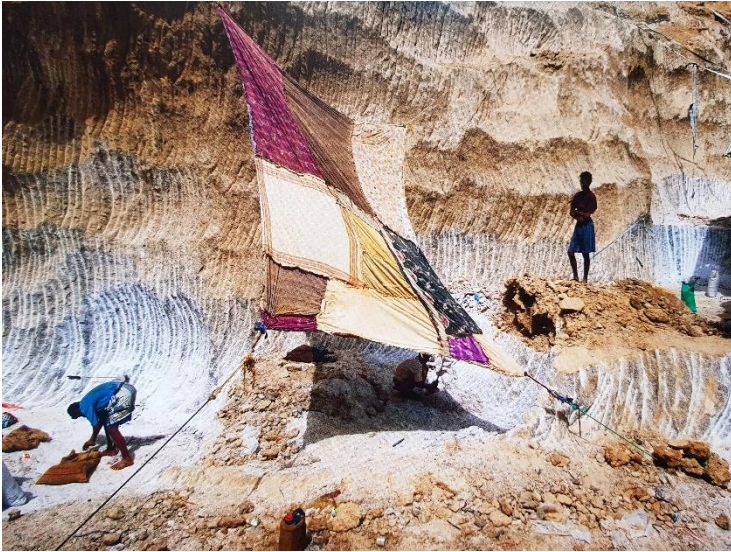


Fig. 5-7: Workers at salt mine at 'Ayādh (Steinmetz 2000: 107)

- To the northwest, through Wādī al-Ma'shār, Wādī Shuqayqat to Arain, 'Irq al-Abtar, and then to the Jawf. The northern road to Najrān starts from Safīr, Ruwayk, el-Jetima;¹⁴
- To the SW, road passes through: Milḥ Kharwah, Jaw al-Kudayf, al-'Ayadīm (Wādī Bayhān), Wādī Ḥarīb, Ma'rib,
- To the East, road leaves Shabwa to the East, first through Aqaybat 'Uqayba pass¹⁵ then to Wādī al-Qamah, Wādī Kunayidhah and from there to Bi'r 'Asākir wells,
- Through Wādī 'Irma, following the wādī course to Maslab and then northwards to wādī Kunayidhah¹⁶.

2.2: Southern salt mines around Sab'atayn basin

In 1870, Heinrich von Maltzan visited Upper 'Awlaqī, mainly the territory of the Ahl Khalifah tribe and the lower course of Wādī Ḥammām. He wrote: "In der Hochebene von Gabt befinden sich die sogenannten "Berge unter der Erde", d. h. Steinsalzfelzen unter dem Boden des Plateaus, zu denen man durch Gruben gelangt. Das Salz findet sich nicht auf der Oberfläche des

¹⁴ See Philby 1939: 359-80.

¹⁵ Pirenne 1990: 51-3.

¹⁶ Hellfritz 1936: 294-6.

Bodens, also find hier nicht etwa Depositen einer ausgetrockneten Salzlagune, sondern wirkliches Steinfalz. Habt versieht die ganze Gegend mit Salz...’’¹⁷

At the mouth of Wādī Ḍura’-‘Abadān, some ancient salt-mines are recorded but no longer worked. One salt-mine, at Najd al-Milḥ, is situated about 10 km northwest of Ansāb/Nisāb.¹⁸ Another one, Najd al-Milḥ, is located further north, some 15 km northeast of Ansāb/Nisāb, dominating the course of Wādī Ḥammām.¹⁹ This is probably the salt mine that G. W. Bury mentions as “al-Hâdinah”, belonging to Ahl Khalifah tribe: ‘The general trend of the Hâdhenah range is eastwards, as it is also that of the great sand ridges. There are marble-quarries there to this day, and rock salt is still worked’.²⁰



Fig. 5-8: Salt mine of ‘Ayadīm/Bayḥān (cliché J. F. Breton, 1980)

At the tail end of Wādī Bayḥān lies the salt mine at ‘Ayadīm, located some 40 km northeast of Tamna’. This is a major mine, measuring some 150 by 200 m and 20-30 m deep (Fig. 5-8). Its size may indicate that mining had

¹⁷ Maltzan 1873: 247.

¹⁸ von Wissmann 1957.

¹⁹ *ibid.*

²⁰ Bury 1911: 247.

been undertaken over a period of several centuries, and it is still worked.²¹ ‘Ayadīm salt is considered as dark (“ein dunkleres Salz”).²² Near ‘Asailān, H. von Wissmann mentions some toponyms: Jaw al-Milḥ and Suqūṭ al-Milḥ, not associated with salt mines.²³

At the tail end of Wādī Abrad, some 150 km northeast of Ma’rib, there are the salt mines of As-Safīr, probably known from antiquity. They are mentioned by Glaser, Müller and Rhodokanakis,²⁴ and then by H. St. John Philby.²⁵

2.3. Salt trade in antiquity and modern times

Salt is rarely mentioned in South Arabian inscriptions. So, even at Shabwa, salt-mine ownership regimes, mining operating systems, workers’ wages, trade organization and the sharing of benefits remain largely unknown. It is impossible to know if worked mines belonged to families, if salt was a royal monopoly (like incense?) and even if salt trade was subject to special regulations and taxes.

Only two texts engraved on palm sticks mention salt (*mlḥ*):

- 1- YM 11729, published by Ryckmans et al. 1994:²⁶
 Line 7: et en outre quatre mis’hâr et une subâ’a de
 Line 8: sel, de lentilles...

- 2- X. BSB 35, published by Peter Stein,
 Line 1: TWBT aus (der Stadt) NSHQM
 Line 2: neunundzwanzigeinhalb
 Line 3: (Mass) Salz nach den dhhb (-Mass)
 Line 4: beglichen...dokumentiert haben dies
 Line 5: der (Mann) aus (der Sippe) HBZN sowie NMR aus (der
 Sippe) THT

The text is dated 370 AD.²⁷

²¹ Glaser et al. 1913: 26.

²² Grohmann 1917: 338.

²³ Von Wissmann, Map 1957.

²⁴ “Zirka 3 Tagereisen östlich von Mârib befindet sich bei Sâfîr ein grosseres Salzbergwerk, das neben dem ein dunkleres Salz liefernden El-Ajadīm östlich von Harîb fast ganz Jemen insbesondere die Gebirgsgewöhner, mit Salz versieht” (Glaser et al. 1913: 26).

²⁵ Philby 1939: 368.

²⁶ Ryckmans et al. 1994: 54-5 and plates: 86-87.

²⁷ Stein 2010: 155-7, Tafel XXXI.

These two texts are not sufficient to assess the salt trade in antiquity. Maybe salt was not considered as an important product when compared to incense or foodstuffs. Nevertheless, all the shepherds, at that time and even now, knew its importance for breeding cattle, as well as goats and camels.



Fig. 5-9: Salt-bags in Shabwa near Miḥ al-Rashīd mine (cliché J.-F. Breton 1975)

2-4: Production and trade during medieval and modern times

In 1976, when excavations began at Shabwa, salt-mines were a common property of the two tribes of al-Burayk and al-Rābiḥ. Workers were supplied regularly by one of the two tribes, and the benefits were equally divided between them. About five bags a day of 25 kg each was produced, and were then loaded on camels (Fig. 5-9). Every month, a caravan left Shabwa to Ḥaḍramawt (to Say'ūn).

Leo Hirsch wrote: “Das Salz, das man zum Verkauf bringt, stammt von Schēbwa (Shabwa), das sechs Tagereisen westlich von Shibām im Lände der Berek gelegen ist, wohin Wādī Irma seinen Lauf nimmt; in derselben Landschaft findet man auch Salz in den nahe Schēbwa gelegen Ortschaften ‘Abida und ‘Iyād. Wie man mir erzählte, zahlt man für den Sack Salz an Ort und Stelle einen Besa (2 pf.), wozu allerdings die Kamelmiethe tritt”.²⁸

In 1888, Eduard Glaser wrote: “Ajādīmsalz holen die Leute von Ḥarīb, Baihân und Marha und bringen es zum Teile nach El-Gûba (in Murâd) oder nach Ḥarīb (und zwar nach El-Derb). Die Murâd und Zabjân verfrachten es weiter nach den Bergen, an welchem Geschäfte auch die Fukarâ von Ḥarīb

²⁸ Hirsch 1897: 205.

teilnehmen, die mit ihren dunklen Salzen gleichfalls bisweilen bis nach San'â kommen. Dieses Salz kostet 1/12 Taler pro Kadah, in San'â jedoch verkaufen sie nur 7/8 Kadah für einen Taler".²⁹

More recently, in 1955, Wendell Phillips wrote about the salt trade of al-'Ayadîm: "The total income in a year's time is considerable for an isolated tribe like the Bal-Harith. The best guess at a yearly production is 2,400,000 pounds of salt (two million four hundred thousand pounds), which brings about 1 Maria Theresa dollar per 100 pounds, or a total of 24,000 Maria Theresa dollars, equivalent to about 12,000 US dollars at the time we were there".³⁰

About 'Awlaqî salt-mines trade, H. von Maltzan wrote in 1873: "Gibt verhiest die ganze gegen. Karawanen kommen aus Yafa', dem Lande. Der Ragaz selbst bis von Reda' und Yerim, früher sogar ganz aus der Nähe von Aden. Das Hoheitsrecht gehört der Regierung, welche von jeden Kamelladung ½ Maria- Theresia-Thaler erhebt das Eigentumsrecht dem stamme der Ghlifa³¹, welche die Salzminen bearbeiten und das Salz verkaufen. Preis der Kamelladung 1 Maria-Theresa-Thaler. Die last wird also für 1 ½ Maria-Theresa-Thaler erworben... Die Ghlifa machen eifersüchtig über die Minen und gestatten Niemanden, der nicht vor ihrem Stamm, auch nur in deren Nähe zu gehen"³².

From Glaser, Rhodokanakis and Müller, we find some information about the social production of salt in Sâfir, northeast of Ma'rib: "Bei Sâfir nun schaffen Beduinen und freigelassene Sklaven des 'Abîdstammes das Salz zutage. Beduinen von Stamme der 'Abîda, der Al Duwajj und der Daham sowie eine zumeist im Gebiete der 'Abîda und in Harîb und Baihân wohnende Klasse von Abkömmlingen der Aulijâ (Plural von Welî, Heiliger), die sogenannten Fukarâ (Arme) oder Mashâih, welche, aus zur Hîgra gehörig, ohne Waffen zu tragen, überall volle Sicherheit und Freizügigkeit genießen, ziehen alltäglich scharenweise mit ihren Kamelen nach Sâfir und laden dort für einen Maria-Theresien-Taler 12-16 Kadah Salz..."³³

²⁹ Glaser et al. add "Das Begwerk von El-Ajâdim ist Eigentum der Bel-Harith (Baihân) und der Fukara von Harîb. Aber bei alledem haben weder die Fukarâ noch die Serife, noch auch die Händler es jemals zu einem Vermögen gebracht, das auch nur entfernt an das eines Rothschild heraneicht" (Glaser et al. 1913: 27).

³⁰ Wendell 1955: 84.

³¹ Probably the tribe Ahl Khalîfah" of the map H. von Wissmann 1957.

³² Maltzan 1873: 247.

³³ Glaser et al. 1913: 26.

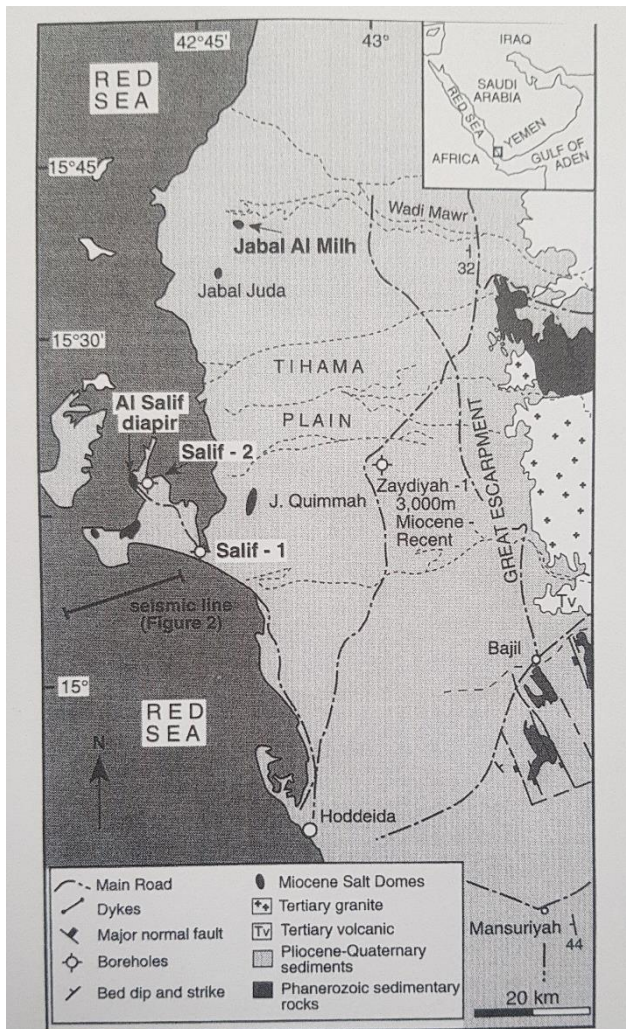


Fig. 5-10: Location map of the salt diapirs in northwest Yemen, Tihāma (Davison et al. 1994: Fig. 9).

3. The Northern Tihāma

In the northern Tihāma, the main halite deposits are thought to be mid- to late Miocene in age and were precipitated soon after rifting of continental crust ceased, when extension became localized at the mid-ocean ridge

spreading center.³⁴ The main halite unit may have reached up to 2 km in thickness. The evaporite deposits overlying the main halite unit are dominated by sabkha and layered gypsum deposits, with individual layers reaching at least 140 m in thickness at the outcrop (at Jabal al-Milḥ), and in offshore wells.

According to Davison and Bosence: “Two diapirs (Al-Salif and Jabal Al-Milḥ) break to the surface near to the present-day Red Sea coastline in Yemen (Fig. 1-10) and salt is quarried down to a depth of 30 m below surface. Six other buried salt structures reach close to the surface in Yemen while salt domes are also known in southern Saudi Arabia at Jizan and the Farasân Islands.”³⁵

The diapir is best exposed in the main salt quarry at al-Salīf and is also known from shallow boreholes to extend in the subsurface at least 1 km to the east of the present-day quarry. The top salt surface reaches a maximum height of 15 m above sea-level, and is quarried to 10 m below sea-level. The Jabal al-Milḥ diapir lies approximately 12 km inland from the Red Sea shoreline, at 45°-44° degrees north, and the regional land surface stands around 30 m above sea-level.

Many archaeological remains have been unearthed in the Rās ‘Īsā Peninsula, and the ¹⁴C dating of shell piles (middens) at the surface has also given dates of 3700 BP.³⁶ This suggests that the first preserved human colonization in this area occurred at about the same time that the beach deposits formed on the crest of the diapir.

In the 10th century AD, salt deposits in the Tihāma are mentioned by al-Hamdānī as being located “in the region of Mawr and al-Mahjam”.³⁷ He presumably means the salt hills in the eastern Wādī Mawr, known as Jabal al-Milḥ, and the two deposits around al-Salīf, one of which is located on the mainland at the base of a gypsum outcrop called Jabal al-Qumah.³⁸

While the salt resources of the Tihāma were probably exploited for local use throughout the Middle Ages, it was not documented as a commercial commodity until relatively recently.

If salt was transported to the Yemeni highlands, we might suggest two hypothetical routes (Fig. 5-11): a northern one, leading from Jabal al-Milḥ to the highlands via Wādī Mawr; and a southern one, leading from al-Salīf southwards to Wādī Sihām, via al-Hamīd.

³⁴ Davison and Bosence 1996: 23.

³⁵ *ibid.*: 27.

³⁶ C. Phillips, pers. comm. 1994.

³⁷ Hamdānī/Müller 1884-1891: 155, II.18-21.

³⁸ Stone 1985: 130-1.

Likewise in the Red Sea, the Farasān Islands are composed of coral and limestone platforms uplifted and deformed by salt tectonics, resulting in a complex onshore and offshore topography which has been subjected to considerable modification by local tectonic movements associated with the uplift of underlying salt deposits (evaporites) and localized solutions, resulting in deep depressions.³⁹

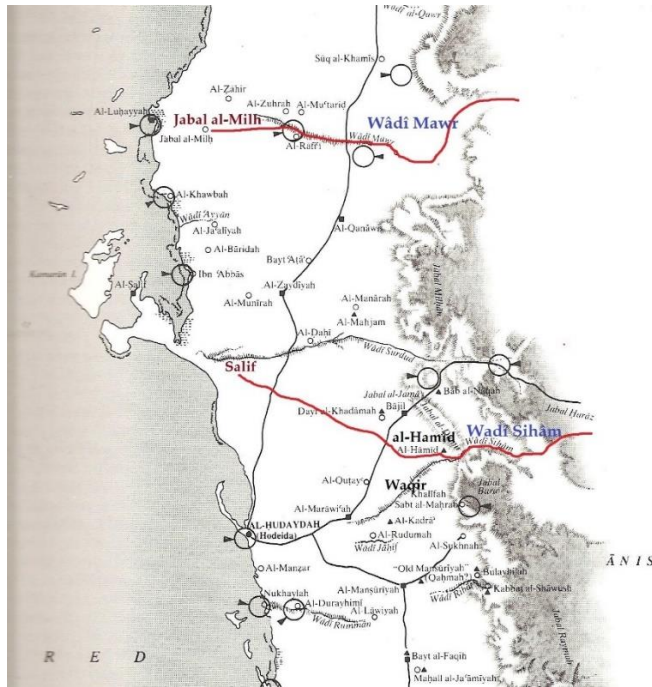


Fig. 5-11: Possible ancient routes from salt mines in the Tihāma to Highlands (map background: Stone 1985, Map 2)

4: The Afar salt production and trade

³⁹ In addition, a series of wells were drilled to depths of a few hundred meters and each passed through a similar succession of strata, although the thickness of the constituent units varied. All of these drillings show limestone, shale intercalated with anhydrite and gypsum, capping a large accumulation of salt (Almalki and Bantan 2015: 122).

The Danakil Depression is a northwest-southeast oriented elongated rift graben that developed in response to extensional tectonics in the Late Tertiary Period. It was connected with the Red Sea until it was cut off from the sea by volcanic lavas during the Quaternary Period.

The huge encrusted Assale rock salt deposit is said to be one of the biggest salt deposits in the world. It is difficult to know exactly how and when this salt deposit formed. The distribution of salt is transported from the mine site to consumers based mainly in the regions of Afar, Tigray and Amhara. In addition to human consumption, a large amount of salt is used for animal nutrition in these regions. Currently, the production of rock salt from the mine site is estimated to be 35,000 tons per year.

The salt-bar sample is collected directly from the surface at Dalol, where miners produce rock salt. The traditional mining area is located near Assale Lake, close to Dalol. To sample the rock salt, excavation is done by an axe. The excavated rock is shaped to a rectangular bar to make it easily to transport. The rock salt sample is taken at 25 cm depth from the surface, and its dimensions are 12 cm in thickness and 40 cm in length. The bar weighs 4 kg.

Once enough blocks have been cut to size, they are carefully strapped together, and then loaded into giant baskets which are slung over the humps of the waiting camels, while the struggling donkeys are put to work carrying precious water for the journey. Each camel is attached to the next, with the head camel who leading the caravan on the long journey to the Afar town of Berhale, where each caravan is documented and taxed before embarking on the week-long journey to Mekelle. There is a southern route from Berhale to Agula' and Kwiha, and a northern route to Segalen and Aksum.

Salt bars acquired the status of real money, not merely quasi-money. *Amole*, as it was called, was not only used in the form of one standard bar, but in different well-defined monetary values.⁴⁰ Smidt writes: "Sources report in addition that with *Amolé* and its subdivisions were accepted everywhere, this was not the case with silver coins, which in some specific local contexts acquired more the status of barter (which could be refused when not needed) in contrast to *Amolé* which was a universal mean of exchange in Christian Ethiopia and neighboring kingdoms in the south, such as Kefa".⁴¹ As there are no archaeological or epigraphic data about the salt trade in Tigray in antiquity, the question as to whether it took place remains unfortunately unsolved.

⁴⁰ Smidt 2018: 177.

⁴¹ Smidt 2017: 244-5.

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