

# A Study on the Salt Production of Ancient Assam<sup>^</sup>

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## 1 Introduction

Study of human civilization has a multidimensional approach. Usually such approaches are based on the study of ideas and religion, but mostly on the study of historic tools and artifacts. In addition to this study of some items, essential for survival of man, play a major role in history. Salt is such an item. The absence or presence of salt was intimately related to different historic events like settlements, the rise and fall of populations, wars, large demographic shifts, the development of agriculture, etc. In the history of North East India the production, use and exchange of salt among the tribes led to several socio-political developments but very little was known about the geological occurrence, characteristics and availability of these salts. In fact, the situation has not much improved during last few centuries. The present study is expected to throw some light on these aspects.

Salt occurs naturally all over the world as the mineral halite, in seawater and as well as salt lakes. Some salt is on the surface as the dried-up residue of ancient seas. Ancient sea beds can also be found underground where salt can be mined. We can make salt from seawater or other salt water sources through evaporation. Until about 150 years ago, salt was one of the world's most sought-after commodities. A substance so valuable that it served as currency, influenced the establishment of trade routes and cities, provoked and financed wars, secured empires and inspired revolutions. North East India in general and Assam in particular has its own history of salt. Assam is a land locked territory, which lacks sea resources. Up to 8th century CE, during the rule of Varmana and Salastambha kings, the Kingdom of Kamrupa (ancient name of present

day Assam) extended up to the Bay of Bengal. As a result, the people of this region benefitted from the sea resources like salt, shell and other trading commodities. But in later part of 8th century, the Salastambha dynasty had fallen and lost its control on the routes leading to the sea. As a result every sphere of life was affected and they were forced to return to some primitive practices. The people of Assam had to search for alternative sources for the commodities essential for daily life. The most unique commodity that the people of Assam extracted locally was salt. Though the process of salt extraction was long in practice, it was considered as an important practice during Ahom rules (1228 – 1826 CE) in Assam.

## 2 Salt producing areas in northeast India

Salt is known to occur in many parts of the Himalayan Mountain belt. However salt producing areas of North East India are located in the eastern part of the region in Naga-Patkai Mountain and on the south bank of the Brahmaputra. The main salt producing area was known as Mohong. According to Sodiya Bornamoi Buranji, *mohong* is a Dimāsā word, meaning salt. *Mo* means mine and *hong* means to boil or to prepare. Historic Mohong area extended from the border of Twensang district of Nagaland to the border of Tirap district of Arunachal Pradesh, up to Namsai district. Medieval chronicles repeatedly mentioned the name Mohong as chief salt producing area. Historic Mohong area was situated within Patkai Range which was known as *Sotai Porbat* among local Kachāri people. There are numerous folk songs referring to salt and *Sotai Porbat*. Three ancient salt producing areas according to medieval Assam chronicles are (Figure 1).

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### 2.1 Namchang-Borhat-Borduaria-Laptang area

This was within the historic Mohong area and included as part of Dibrugarh district of Assam and Changlang and Tirap district of Arunachal Pradesh. It started from “Borhat” and extended along the Naga-Patkai foot hills up to Namphai reserve forest which also include part of Naga Hills. The area extends between latitude  $95^{\circ}18'30.3''$  E and  $95^{\circ}8'13''$  E and longitude  $27^{\circ}05'12.7''$  N and  $27^{\circ}00'53.0''$  N.

### 2.2 Sodiya area

Sodiya is a frontier area to the eastern most part of Assam, which was a part of historic “Mohong” area. Several British reports have mentioned about the availability of salt wells in Sodiya. Francis Buccanon Hamilton’s account of Assam mentioned that for many centuries Sodiya Salt mines (springs?) were under supervision of an officer, ranked as Mohongghat Baruah. Historic salt producing springs were centered around a place now well known as “Lathao”, popularly known as “Bordhol” among local Kachāri population.

### 2.3 Semkhor village

Semkhor is a historic village in Dima Hasao district of Assam. Semkhor (Lat  $93^{\circ}18'04.7''$  E and Long  $25^{\circ}16'40.4''$  N) is probably the most remote and oldest village of that region which has been continuously inhabited by humans. Presence of three megaliths in the village shows the presence of some other prehistoric ethnic group in the village. The Semkhor village is situated in the hills of Barail range covering an area of 406 hectares. The village is surrounded by hills and rivers from all sides, with the main river being Langting (Figure 2).

After extensive study of medieval chronicles and British reports six brine wells and two salt producing furnaces are identified in Mohong where only two wells are found active. In Semkhor out of five salt wells only two are in active state. So far, no salt producing well could be identified in Sodiya region. The Table 1 shows the locations and states of conditions of the salt springs studied.

The word *pulung* is a Dimāsā word meaning ‘salt’ and perennial spring of Pulung is under the control of one Nocte Tribal king. The local Nocte tribes consider it as sacred and protect it from outside interference (Figure 3).

Borduaria well was most famous and supposed to be the biggest historical salt well in Mohong. At present the well is almost dry and as per the local people about for last 100 years no one had visited this place. This well is now the property of the most powerful tribal king, “Borduaria king”. Now the whole well is covered with very thick vegetation. Two deserted salt producing furnaces were found here. Khela is a Nocte village and this village has one small but nicely maintained salt well of Mohong. The brine comes out through some seepages available in Disang Shale of the area. This village still carries the tradition of local salt production. The administration of the well is controlled by the local tribal king of Khela (Figures 4 & 5). Saraipung is an abandoned salt well of Mohong. The brine routes are now totally closed. But wild elephants frequently visit the localities as the salted soil are their favorite food. Doyapung was the historically famous Borhat salt well of Mohong. But this salt spring is already abandoned due to the lack of maintenance. Borpung was also part of famous historic Borhat salt well and now abandoned. Two Semkhor wells are located in the present Dima Hasao District of Assam. Both the wells are close to each other and located at the bottom of the valley near present Semkhor Village (Figure 6). Geologically the wells are located in the Dishang Shale Group of rocks. Salt-springs exist in Cachar District of Assam, both in the southern ranges (Sirispur and Bhuban hills) and in the Barail. Those in the Hailakandi Valley, Mauzas Bansbari and Chandipur are the only ones which are now worked. The springs are leased annually for a trifling sum; the brine is not boiled down, the water being disposed of in earthenware to the people of the neighboring villages.

## 3 Salt producing people

The contemporary politics of the region as well as livelihood of different groups of peoples had direct relation with the production of salt. As a result different tribes or groups of people were involved in the process of salt production.

**Dimāsā** a well-known tribe (also named as “the Kachāris” in mediaeval chronicles) lived in Assam since 2000 BCE. Linguistically the Dimāsā-Kachāris belong to the Tibeto-Burman family. In the 9th century, Dimāsās established their kingdom in the central and eastern parts of Assam and are



**Figure 1** The map showing three salt producing villages of Assam.



**Figure 2** Semkhor Village.

known to be the first tribes to produce salt from Mohong area. Such salt productions practices were before the advent of the Ahoms in 1228 CE and the Nagas. When the Ahoms occupied the Dimāsā territory, they engaged some Dimāsā people for salt extraction. There are six groups Kachāri origin people residing in the salt producing area of Sodiya and Mohong. They are (i) Sonowal, (ii) Khamyang (iii) Mohong (iv) Duania (v) Hazong (vi) Kheremial. Among these clans, the Sonowals, the Mohongs and the Kheremials have been staying here for several centuries. Probably Mohong clan was related with salt production. Some shaped rock pieces are seen near Phulung salt well, considered to be of Kachāri origin.

**Semsas** are a small isolated population, restricted to only one village, known as Semkhor in Dima Hasao District of Assam. Semsas, the most conservative group of the Dimāsā confined themselves to the villages Semkhor due to some mythical or legendary reason and consequently become an endogamous section of the Dimāsā. From 16th century the Semsas carefully protected the salt wells from outsiders. The Semsas are still having traditional cultural traits, including the language of the Dimāsā tribe. Marriage rule among the Semsas is strictly guided by the principle of double descent system. They strictly follow village endogamy and no one is supposed to marry outside the village (Figure 7).

**Lonpungias or Lonpuriyas** (salt-makers) were the con-

tingent of Ahom kings sent to the salt springs for preparing salt. Lonpuriyas were from Assamese heartland and at present it is very difficult to distinguish them. The existence of several Lonpuriya villages in Assam indicates the existence of these salt makers. There are several groups (known as 'khel') of Lonpuriyas. They are Longpotiyas, Longsowals, Dhadumiyas, Chirupuriyas, Jogodumiyas and Longtingiyas. These Lonpuriyas were recruited from different tribes. Lonpuriyas are found among Chutias, Ahoms, Kachāris and Moran Tribes. The groups engaged in supplying firewood for salt making were known as Borkheremiya and Sarukheremiya. The Longpotias are especially engaged in supplying 'kaupāt', a type of leaf (*Phrynium pubinerve*) for wrapping the produced salt. All these salt related workers of Mohong were known as Mohongiya. Medieval Ahom chronicles repeatedly used the term 'Naga' with their village name as the prefix, for salt producing Hill people. British used the term Eastern Naga for these. Though these people were originally of Naga origin, but they are now considered as a distinct tribal group. Traditional salt producing tribal groups were Noctes (includes Borduaria, Paniduaria and Namchangias), Tutsas and Tangshas.

**Noctes** entered Tirap district from Mayanmar during 16th Century. They use the word 'Sum' for salt. There were eighty five salt wells in the area inhabited by Nocte though most of the wells are dead be-



**Figure 3** The Nocte king is collecting salt spring water from a Pullung Well.



**Figure 4** Khela Well.



**Figure 5** Khela, the last salt producing village of Mo-hong.



**Figure 6** Semkhor Well.



**Figure 7** Samsa People (Photograph by author).



**Figure 8** A Nocte girl displaying traditional salt packets.

**Table 1** The locations and conditions of the salt springs studied.

Sl. no	Name	State	Locations	Area	Condition of Salt well
1	Phulung (Tirap district)	Arunachal Pradesh	N 27 0 02'42.1'' E 95 0 27'33.1''	Mohong	Active
2	Borduaria (Tirap district)	Arunachal Pradesh	N 27002'29.4'' E 95027'44.3''		Dry
3	Khela (Tirap district)	Arunachal Pradesh	N 27000'53.0'' E 95032'35.4''		Active
4	Soraipung (Dibrugarh district)	Assam	N 27005'12.7'' E 95016'06.9''		Dry
5	Doyapung (Dibrugarh district)	Assam	N 27006'26.7'' E 95019'14.3''		Dry
6	Borpung (Dibrugarh district)	Assam	N 27006'31.8'' E 95018'30.3''		Dry
7	Semkhor (Dima Hasao district)	Assam	N 25016'40.4'' E 93018'04.7''	Semkhor	Active

cause of lack of proper maintenance. The Noctes are still producing salt from their traditional sources and they are the last tribe doing so (Figure 8). Salt producing Noctes had several clans with different names such as Barduria, Paniduria, Namchangia, Takam and Khampa Nagas, based on the names of the places they inhabit.

**Borduarias** (Borduar meaning big door) were Nocte people residing in an around village Borduar. Initially they fought several battles against the Ahoms for salt, but later maintained a cordial relationship with them. Their duty was to strictly guard the eastern land route to Ahom kingdom. The Bordaria had twenty one villages under them. The village Paniduar is situated on the right bank of the river Disang which flows from Patkai Mountain Range. The Nocte people of Paniduar village and its adjacent areas were known as the Paniduarias. Disang River was the eastern water route to Ahom Kingdom which was guarded by the Paniduar Noctes. Namchangias are the Nocte people from the village Nam-

chang and its adjacent area. There are total forty five subordinate villages under Namchang.

**Tutsas** primarily live in Changlang and Tirap district of Arunachal Pradesh. They entered the present location during end of the 12th or early 13th century. There are reports of existence of several salt well in Tutsa villages. Medieval Ahom chronicle did not mention any salt related conflict between the Tutsas and Ahom but oral traditions speak about a lot of conflict between them. Tutsa were considered to be a part of Nocte tribe, but now they have their own identity.

**Tangshas** are inhabitant of Tirap and Changlang district who migrated from Myanmar during 12th century. Some salt well in Tangsha villages has been reported. Medieval Ahom chronicles do not directly mention any conflict between Ahoms and Tangsha for salt.

**Mattaks** are Mongoloid group of people, used to reside in the eastern most part of the Ahom Kingdom. The word Moran is synonymously used for Mattaks. In

1805 CE, they had established a short lived tiny kingdom in the easternmost border of Assam. There is no written record of Mattaks trying to exploit the salt springs of eastern hills however Tutsa oral history tells us about attempts of Mattaks to exploit the salt wells of Tutsa areas.

#### 4 Political history and salt in Assam

The political history of ancient Assam has always been full of conflict between indigenous people and invaders at different times. The cause of conflict, many a time, was not merely for holding power on land or water, but controlling other commodities as well. Salt being the most precious commodity in ancient Assam, there were series of wars among different groups to maintain the hegemony on the salt well, particularly in Mohong area.

The Mohong area was under the control of Dimāsās people during in mediaeval period i.e. before Ahoms entered Assam during 1228 CE. A medieval Ahom chronicle, written on the Kachāris, indicates the annexation of Mohong by the second Kachāri (Dimāsā) king Vikramidityapha, probably from some Naga group. The Dimāsās employed their people to extract salt from the wells available here. The descendent of the Kachāri people engaged in salt production are still living in the Mohong area and they are known as Mohong clan.

In 1228 CE, a small group of Shan people (later known as the Ahoms) under the leadership of Prince Sukafa, entered Assam through Mohong area. The Ahoms drove away Bisārpoti Dersangphā, the representative of Dimāsā king from Mohong. From this time, at least three recorded conflicts took place between the Dimāsās and the Ahoms. But the Ahoms were finally successful in retaining their position in Mohong and the Dimāsās discovered a new source of Salt brine at Semkhor in Barail Hill ranges of present Dima Hasao District of Assam. During 16th century new groups of people from western part of Patkai Hills, collectively named as Naga by the Ahoms and Eastern Naga by the British, slowly entered the Mohong area and took control over several salt wells. These people call themselves as the Noctes. The Ahoms retaliated back and a series of salt related conflict took place.

In 1701 CE, during the reign of King Rudra Simha (Sukhrungpha), the Noctes attacked the Royal Salt factory at Borhat and killed many of royal officials. Ahom

king sent a strong contingent under Basang Phukan. The Noctes surrendered to Phukan and the Ahom king forgave the Noctes. This is the last major conflict between the Noctes and the Ahoms for salt. After this major event, King Rudra Simha decided to solve this Naga problem through religion. He sent Sriram Aata of Chaliha Bareghar Satra, a vaiṣṇavite monastery to eastern hills and baptized the Nocte King Lotha khunbao to Neo-vaiṣṇavism. This move of Ahom King worked. After conversion of Lotha Khunbao to Neo-vaiṣṇavism, there was no conflict for salt for 106 years i.e. upto 1807 CE. But during Moamoria revolution (1769–1805), the Ahom monarchy became very weak. In 1807 CE, during the reign of King Kamaleswar Sinha, Noctes of Borhat area again revolted. However, the Ahom king managed to suppress the revolt. Thus, the Ahom-Nocte conflict which started in 1536 CE continued up to 1807 CE. Moreover the oral literature of Tutsas contains valuable information on several conflicts which took place in 17th and 18th century between the Tutsas and the Ahoms. In 1939, the British took complete possession of the Ahom kingdom. The commercial exploitation of salt stopped forever as they found it much cheaper to import Bengal sea salt than to produce from Eastern Hill.

#### 5 Management and taxation on salt in medieval Assam

Salt well management was a very important part of medieval administration. Though, no information could be found regarding salt well management of Dimāsā administration, the Ahom chronicles give us some information on Ahom management of salt well. In 1536 CE, King Suhungmung took the possession of the salt wells from the Noctes and tried to establish a system of exploitation of the salt. The Royal family used to take out the salt necessary for their monthly use and rest was sold in the market after paying a sales tax. During the reign of King Pratap Sinha (1603–1641 CE) a new top administrative post known as 'Borbaruah' was created in Ahom state. Momai Tamuli was the first person to hold the position of Borbaruah. He initiated some major administrative reform like systematic exploitation of salt from Mohong wells. He brought the hill people under taxation, in forms of kinds produced in hills including salt. The taxation system indicates that up to this point, the salt producers were

mainly the Noctes. Though the Ahom monarchy took the possession of the salt well, the production was still in the hands of the Noctes. They enjoyed their right on the salt wells after royal supply and paying a nominal tax.

During the regime of King Godadhar Sinha, the Ahom court tried to maintain its own salt manufacturing units in Borhat area resulting in tension and fight between the Noctes and the Ahoms. The Noctes attacked the salt manufacturing units (Lonsal) and at least two such intense fights were recorded in the Ahom chronicles in 1690 and 1692 CE. To avoid such situation, the Ahom monarchy decided to restore a full flagged officer in Borhat-Namchang area to monitor the salt extraction process. During the regime of King Rudra Sinha (1696–1714), one officer, known as ‘Mohongia Baruah’, was appointed to look after the salt extraction work. From that time the officers and workers of Ahom king were directly involved in salt production. The Noctes also had right to salt production for their own. The Noctes also helped the royal workers in salt production and they were rewarded for help. They got one third of the total produce and remaining two third were sent to king. In Sodiya region, another officer was appointed to monitor the salt production. He was known as Mohanghat Baruah. According to Francis Hamilton, Mohanghat Baruah used to contribute rupees 40,000 per annum to royal treasury.

In 1819, the Burmese invaded Assam and occupied it. After Anglo-Burmese war, the territory of Assam was handed over to British. In 1833, British restored Purandar Simha as a vassal king for an annual Tax of Rs. 50,000 per annum. At that time little resources were left within the territory and Purandar found it difficult to pay the tribute. So he imposed a very heavy tax on salt wells of Mohong. Purandar Simha, the last Ahom monarch asserted his right over the salt-wells very successfully but original Ahom bureaucracy had broken down and one ‘Pani Phukan’ (Royal admiral) was in-charge of salt production. During the time of Purandar Simha, the organization of original Ahom salt making broke down and he forced the Noctes to work in the salt wells for him. The heavy duties on salt production created dissatisfaction among the Noctes who regularly raided the border villages and salt production almost stopped.

On 16th September, 1938, the British took the possession of the kingdom of the last Ahom king Purandar Simha. They found Borhat, the most important salt trad-

ing center of Mohong, a deserted place and there was no cultivation around. Once these salt trade centre gave Rs. 3000 per year to King. Captain Jenkins gave a detailed description of the tax pattern imposed by King Purandar Simha and management of salt production. After dethroning King Purandar Simha, British East India Company became the successor of salt wells of Mohong area. American missionary Miles Bronson, who was more familiar to the Noctes than any British official advised Jenkins to retain control over half of the salt wells like Ahoms (Foreign Political Proceedings, 1840, 9 November, No. 82). Bronson thought that such an action will help maintain peace and preserve Government’s interest. Bronson thought that British Government made the Noctes dependent on government in the same way as King Purandar Simha.

Captain Brodie, Principal Assistant of Sibsagar, deputed C. R. Strong, Sub Assistant Commissioner, in the cold season of December to inquire into and report on all salt wells and suggest alteration if any in the duties which might lead to the restoration of peace and good will among the Noctes. Strong identified a total of 85 salt wells (Namchang area - 54, Bor Duwar area - 19, Panee Duwar area - 12) with specific names in three localities of Nocte heart land. According to Strong, except one or two, every well had king’s share. From his report we are able to know that the king was supposed to have a share in four of the Namsang wells; three belonging to him entirely and in the fourth one a claim of 8% or 8 *hals* (salt manufacturing units). In Borduaria possession, the king was entitled to two out of 17 *hals* during night in one well and two out of 27 during day time in another. In Paniduarua wells, king was entitled to one *hal* out of 20 during the night (Foreign Political Proceedings, April 4, 1838, No. 83). A report from British library indicated that in 1848 CE, they tried to produce salt experimentally from Brine springs from Assam border by giving permission to someone named Mr. Bonsal (Figure 9). Probably this experiment was not successful. British Government never intervened in salt production in North Eastern Hills. They banned local salt production in entire India except North Eastern Hills probably because of its low profitability.

Though Bronson had suggested running the salt well by government, but Bonsal’s experiment proved so negative that the British Government abolished all duties on salt and handed over all the wells to the Noctes. Accord-

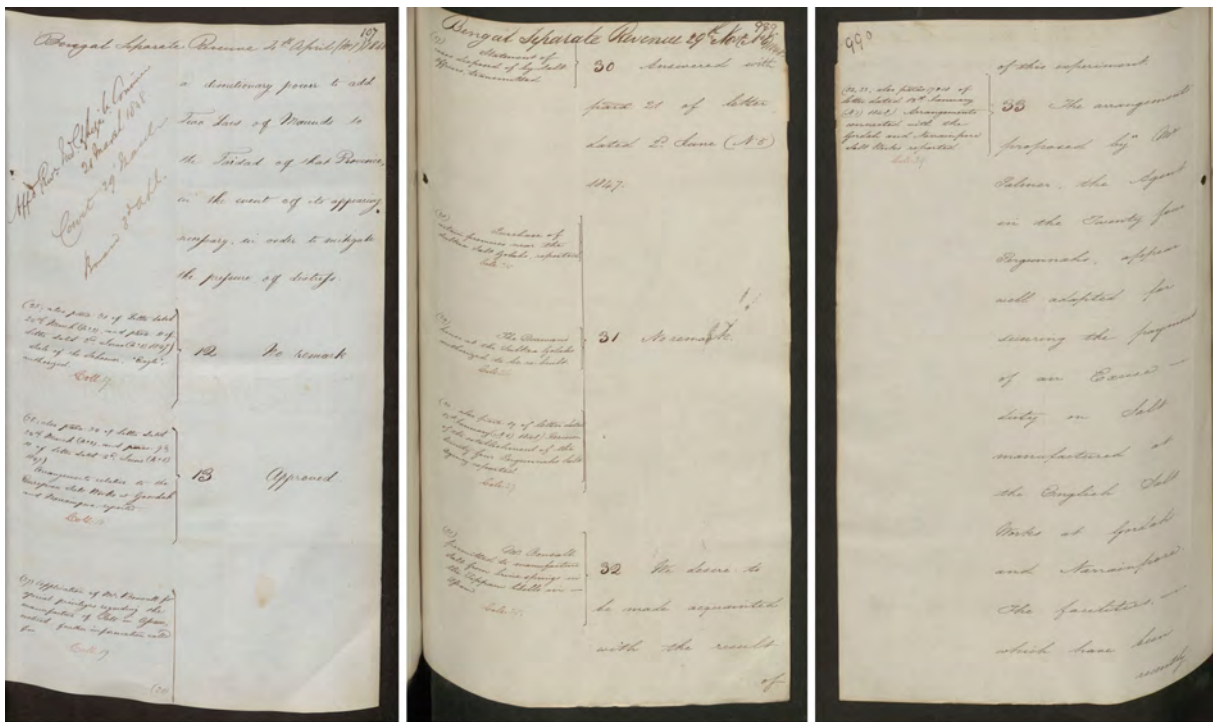


Figure 9 Bonsal’s report on Assam Salt preserved in British Library.

ing to William Robinson, the revenue derived from Sodiya springs in 1809, amounted to about 40,000 rupees per annum; and the salt obtained from springs was said to be purer, and highly prized than the one imported from Bengal. At one time the quantity amounted to no less than 1,00,000 maunds (Pemberton 2015, p. 82).

## 6 Salt production techniques

Several salt production techniques were noticed during field and literature studies. But all techniques are basically based on evaporation technique with minor difference and modification. Salt extraction usually commenced in November, and continued till March or April as the wells being situated in a valley were subject to inundation during the rainy seasons. The wells found in the beds of rapids were only available for salt extraction in the cold season, or in the absence of inundation. The wells naturally varied in size, some being very deep producing more brine, averaging from two and a half, to three feet in diameter, and the shafts were frequently protected by a lining of wood or a hollow tree. But sometimes ar-

tificial wells were also dug. During field visit, the local people described a simple primitive method of salt production through evaporation. They made some open furnaces with blocks of rock. These furnaces are actually two parallel walls of rocks. Near Borduwaria area, there were two big furnaces dry and abandoned in deep forest which must be several hundred years old. The location of the furnaces is  $27^{\circ}02'29.4''$  and  $E 95^{\circ}27'44.3''$ .

Local tribal people prepare clay coated bamboo tubes which are filled with brine and the tubes are placed on the furnace. When brine water boils and evaporates, they again add more brine water to the clay coated bamboo tubes. The clay layers protect the bamboo tubes from burning. This repeated evaporation process yields a cylindrical shaped salt piece.

Miles Bronson, the first Christian missionary visited Mohong area near Namchang and gave a description of extraction of salt by the Noctes. According to Bronson, the Noctes started working at the salt springs in the morning hours at about 10 o’ clock. They fetched water from deep wells situated nearby having dissolved salt, by a bucket of leaves and collected it in a large wooden vessel for boil-



**Table 2** The geological horizons of areas where the salt were found.

Sl. no	Name	State	Locations	Area	Geological horizons
1	Phulung well (Tirap district)	Arunachal Pradesh	N 27 <sup>0</sup> 02'42.1" E 95 <sup>0</sup> 27'33.1"	Mohong	Disang shale
2	Borduariya (Tirap district)	Arunachal Pradesh	N 27 <sup>0</sup> 02'29.4" E 95 <sup>0</sup> 27'44.3"		Disang shale
3	Khela village (Tirap district)	Arunachal Pradesh	N 27 <sup>0</sup> 00'53.0" E 95 <sup>0</sup> 32'35.4"		Barail Sandstone
4	Soraipung (Dibrugarh district)	Assam	N 27 <sup>0</sup> 05'12.7" E 95 <sup>0</sup> 16'06.9"		Disang shale
5	Doyapung (Dibrugarh district)	Assam	N 27 <sup>0</sup> 06'26.7" E 95 <sup>0</sup> 19'14.3"		Disang shale
6	Borpung (Dibrugarh district)	Assam	N 27 <sup>0</sup> 06'31.8" E 95 <sup>0</sup> 18'30.3"		Disang shale
7	Semkhor (Dima Hasao district)	Assam	N 25 <sup>0</sup> 16'40.4" E 93 <sup>0</sup> 18'04.7"	Semkhor	Dishang Shale

ing. The boiling method was very rude and primitive. For the purpose of boiling they built a construction in the shape of an arch with stone and clay. Bamboos having one joint were cut and spread tightly over the arch in the shape of boats. The boats were filled with brine and then a large fire was kept blazing under the construction without any injury to the bamboos. Miles Bronson counted sixty such bamboo boats and the Noctes informed him that they would get twenty to twenty five boats of salt by boiling brine in sixty boats of bamboo (Foreign Political Proceedings, 1840, November 9, No. 82).

According to U. N. Gohain, the wells were dug at various places and marked with hollow tree trunks. From these wells water having slight saline taste was scooped out and stored in coarse bamboo vessels. Near each salt well rude furnace with baked clay open at the top was constructed. The bamboo vessels were placed side by side across the opening, and the furnace full with fuel was lighted. The fire was lighted till the process of evaporation was complete and till the salt particles were deposited in the vessels.

According to Willam Robinson, the salt was manufactured in the winter season i.e. in the months of November and December and continued up to March as brine wells were inundated by rain during rainy season. The process of manufacture was carried on by filling the joints of large bamboos with the water of the wells, and then placing them over a flue to which a fire was applied; the brine in the bamboos thus evaporated, and dry salt remained. The bamboos were stripped of their woody covering, and only a thin scale of the inner wood was retained until the salt became dry and was removed. One joint could thus be used over the fire for three or four times. This was an exceedingly slow and wasteful process.

According to John Owen, the place of manufacture is generally selected at a convenient distance between jungle and the well, so that fuel is at hand for feeding the furnace. The *Hal* (Furnace) is of mud work, sometimes sixteen or eighteen feet long, and three to four feet wide; perhaps three feet in height, with sufficient space all up the centre forming a flue. These *chungahs* (Bamboo tubes) or joints of bamboo would rest on it. The *hal*, in some

instances, is covered with a grass thatch, and has an adjoining hut on elevated poles used as a sleeping place and protecting from wild animals for those who come to manufacture. The Fire being lighted at one end, the *chungnhs* are placed close together on the top, at right angles to the building, and are filled and constantly replenished with brine as evaporation takes place.

## 7 Geology and chemistry of salt of Assam

Though the history of salt of North East India is quite old, there has been no major effort to study its geological significance. Organizations like Geological Survey of India (GSI) have published some data on the locations of the salt wells. According to GSI, the springs are seen invariably at the base of the valley near surface drainage. The depth and diameter of the wells vary from 1 to 2.5 m and 1 to 1.5 m, respectively. GSI has attempted to estimate rate of recharge for some of the wells which varies from 1 to 3 cubic meters per hour or 1000 to 3000 litres per hour (24 to 72 tons per day). There are indications that salinity of water gradually increases from south to north. So far, no study has been made on its mode of occurrence, geological age, or nature of its lithological or structural control. The scope of the present study does not allow for an extensive geological fieldwork. However, during the field studies locations of the salt wells were properly noted with GPS and subsequently correlated with the geological and structural map of the area and satellite images. The observations are mentioned in Figure 10 and Table 2.

### 7.1 Mode of occurrence

In the Himalayan region, salts mostly occurred in hard form and commonly known as 'rock salt'. Though, geologically the history of mountain formation of the Himalaya and Naga-Patkai region are similar, there are no records of rock salt occurrences in Naga-Patkai region. All salt found here is in the form of brine occurring in subsurface conditions dissolved in ground water and spring out as salt spring.

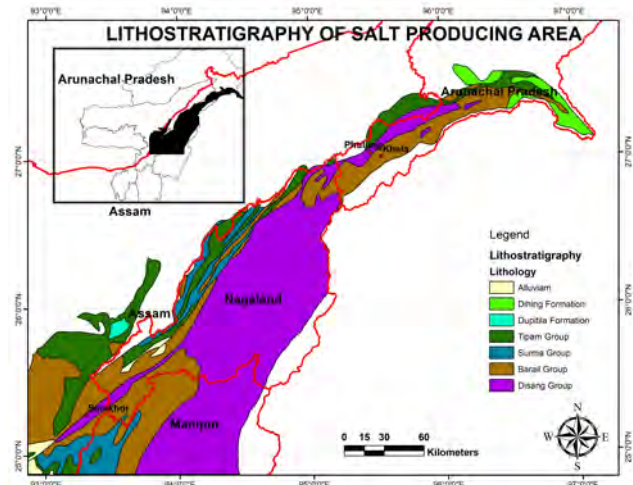


Figure 10 The Lithostratigraphy of salt producing area.

### 7.2 Geological horizons

The springs are found to exist in different geological horizons. The Pullung well is situated within the Dishang Shale of Tertiary sequence of Assam-Arakan Basin. It was noted that brines coming out from the bottom along with some sand lenses lies within impervious Dishang Shale. These lenses are composed of hard sand stones. The other active well at Khela is situated within very hard almost impervious Barail Sandstone beds of Assam-Arakan Basin. The age of the salts found in this area is difficult to assess as it cannot be correlated to any geological formation. Since there is no salt bearing formation in the area and the brine is least turbid, probably these are the remnant of the trapped water of ancient Tethys Sea after Himalayan upheaval.

For a better understanding of the geological succession of the area and the geological horizons, Information from the Ground water Booklet of Tirap District is given in Figure 10 and Table 2.

### 7.3 Geological structure

While plotting the geographical position of the salt spring in Mohong area, as per the location recorded through GPS, it appears to follow a lineament along northwest-southeast direction. It appears that the salt spring are more likely to be controlled by geological structure rather than lithology. The NW-SE trend followed by the salt

**Table 3** The chemical analysis of major ions and elements present in various brine systems.

Elements/Analysis	Khela	Semkhor	Phulung
Sp. Gr	1.0273 (3.85 °Be)	1.0059 (0.85 °Be)	1.0409 (5.70 °Be)
Ca <sup>2+</sup>	0.51 %	0.0056%	0.06%
Mg <sup>2+</sup>	0.29%	0.0054%	0.07%
Cl <sup>-</sup>	2.32%	0.400%	3.51%
SO <sub>4</sub> <sup>2-</sup>	Traces	Traces	Traces
K <sup>+</sup>	0.0024%	0.0022%	0.0039%
CaCl <sub>2</sub>	1.42%	0.0155%	0.18%
MgCl <sub>2</sub>	0.11%	0.211%	0.26%
KCl	0.0045%	0.0042%	0.0076%
NaCl	3.51%	0.6152%	5.16%

spring locations is mainly limited to the hilly region of Naga-Patkai hills. But if the trend is further extended to NW direction i.e., towards the Brahmaputra valley, it coincides with some other prominent features. One important feature is a prominent river channel anomaly of Burhi Dihing river. The overall northeast to southwest direction of the course of the river abruptly changes its course to southeast to northwest direction along this trend. Towards further NW direction the lineament coincides with the northern most point of the southern bank of the Brahmaputra River, where prominent bend of the mighty river is quite visible. It appears that something is restricting southward migration of the Brahmaputra at that point.

#### 7.4 Chemistry of the salt

The composition of the brine samples collected from the studied area shows a composition of common salt. The chemical analysis of major ions and elements present in various brine systems were carried out at Salt and Marine Chemical Research Institute, Bhavnagar, Gujarat and the results are shown in Table 3.

## 8 Conclusion

Geological occurrence of salt or rock salt in the Himalayan belt is common. However, in Naga Patkai Mountain Range the salt occurred in the form of brine of natural spring and well. Eastern Hills were the only source of salt for the land locked North East India and it played a crucial

role in economy and politics of medieval period of this region. The ethnic groups like the Dimāsās had control over salt producing areas since eleventh century with no major conflict. But after the migration of the Ahoms to Assam in 1228 CE, salt become a major cause of their conflict between Dimāsās. It compelled Dimāsās to migrate several times from place to place, to finally settle at Khaspur in Barak Valley. The political dynamics of Ahoms dynasty, many a times was decided by the state of their control over the salt producing wells. The Ahom Kings had to maintain their diplomatic relation with these salt producing people through different means. In some cases these salt producing people were given important positions in the King's Court, while sometimes these groups were motivated or controlled by sending vaiṣṇavite spiritual leaders or saints. These conditions prevailed till the advent of British rule to this region and with no salt import from outside. Only after a commercial treaty between Captain Welsh and Gaurinath Singha, the then Ahom King of Assam on 28th February, 1793, salt from Bengal entered Assam. Slowly the demand for hill salt declined and now it exists as ritual practice only. The chemical composition of these brines resembles with rock salt. No important constituents are noticed which can make it specifically valuable and the common belief about its medicinal value is only of ritualistic importance.

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