

**THE SALTPETRE INDUSTRY IN
THE BENGAL PRESIDENCY
(1793 – 1814)**

**THESIS
SUBMITTED TO JADAVPUR UNIVERSITY
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY (ARTS) IN HISTORY**

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Certified That The Thesis Entitled

“The Saltpetre Industry in the Bengal Presidency (1793-1814)” submitted by me for the award of the Degree of Doctor of Philosophy in Arts at Jadavpur University is based upon my work carried out under the supervision of Dr.Mahua Sarkar, Professor, Department of History, Jadavpur University. And that neither this thesis nor any part of it has been submitted before for any degree or diploma anywhere / elsewhere.

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INTRODUCTION

Saltpetre was a unique industry in the Bengal Presidency which was totally depended on environment. The entire organization of production of saltpetre was carried on with the help of favourable season, weather and environment. Without the support of congenial climate, soil or earth and environment, collection of raw materials, filtration of crude saltpetre and boiling of brine were impossible. Geographically Bihar was the ideal place for such type of soil. The earth impregnated with the materials of saltpetre possessed various types of chemical substances. The earth or soil of some parts of Bihar contained such chemical substances for making saltpetre. The saltpetre was produced in a soil which contained a large proportion of saline matter such as nitrate of potash, nitrate of lime, sulphate, and nitrate of soda and carbonate.

But before proceeding further, a few words are essential about the term 'Saltpetre'. This term evolved from the medieval Latin terms *salpetre* and *sal*

petrate. Petras, in ancient Greek, meant rock, stone. Saltpetre therefore means 'salt of the rock'. Egyptians referred to saltpetre as ntr. In Biblical Hebrew it was nitre. In chemistry, saltpetre is known as KNO_3 or potassium Nitrate. It is an essential ingredient for making gunpowder. However, saltpetre was used for medicinal and antiseptic purposes like preservation of fish and meat, in glass making, bleaching, washing and cooling purposes.

Like opium and salt, saltpetre was another example of monopoly industry under the East India Company. However, unlike salt and opium manufacture, it was a government monopoly for a limited period only. The monopoly was effective between 1793 and 1811 and again between 1813 and 1814. Therefore the time frame of the present research project has been selected from 1793 to 1814. The Province of Bihar was the principal centre of this industry. Trihut, Chapra, Singhia, Saran were some of the important centres of saltpetre production in Bihar. Patna was one of the busiest marts in India for export of saltpetre. As saltpetre was an essential ingredient for gunpowder manufacture, it attracted the

attention of the European Companies like the Dutch, the French and the English for the purpose of war. They considered saltpetre as a force behind the empire. The idea of monopoly in saltpetre at first came in the mind of Robert Clive. In 1757 – 58 Clive secured from Mir Jafar the sole right of the East India Company to the manufacturer of saltpetre in Bihar. Finally in the wake of the French Revolutionary war when saltpetre had great demand in England, the monopoly on saltpetre was imposed on 11 June, 1793 by the Governor General in Council with the advice of the Court of Directors of the East India Company. The monopoly was ended in 1814. ¹

Review of the Existing Literature

No full-scale research has yet been done on this subject except a small chapter written by Prof. H.R. Ghosal in his book 'Economic Transition in the Bengal Presidency'. A few historians have only touched upon the subject. For example, J.C. Sinha (Economic Annals of Bengal) Milburn (Oriental Commerce), Jagadish Narayan Sarkar (three short articles on saltpetre trade in 17th Century India), K.K. Datta (Studies in the History of Bengal Subah), Amales

Tripathi (Trade and Finance in the Bengal Presidency), N.K. Sinha (Economic History of Bengal Vol. II). Recently two articles have been published on Indian Saltpetre Industry written by James W.Frey and A.Nuraag Sanghi. But no historian has dealt with the nature of British monopolistic control over the commodity and the mechanism of manufacturing saltpetre. No historian has dealt with the manufacture of saltpetre from environmental perspective although it is true that without the help of congenial environment the making of saltpetre was difficult particularly in the Bengal Presidency and specifically in Bihar. No writer has given attention to the organization of production of the commodity. Actually the writers gave more attention to saltpetre trade rather than production on which this dissertation has given special emphasis. The nature of participation of the indigenous merchants in manufacture and trade of saltpetre has escaped the attention of the scholars. Only scant attention has been given on extent and volume of production and trade of saltpetre pursued by the East India Company.

Central Question of the Thesis : Impact and Role of Environment on Saltpetre Industry.

The thesis wants to throw new light on the production of saltpetre in the Bengal Presidency by highlighting its total dependence on environment. Without the support of congenial climate, soil and environment, collection of raw materials, filtration of crude saltpetre and boiling of brine were impossible. Nitre, an important ingredient of raw material was abundantly available in clear frosty weather. In a moist state of atmosphere the formation of nitre either did not take place or went on very slowly. Raw materials for manufacturing saltpetre were collected in different seasons and by different methods.

An important argument of the dissertation is the utilisation of saltpetre by the British Govt. in making gunpowder necessary for European War and building up the empire. By establishing monopolistic control over saltpetre industry in the Bengal Presidency, the East Company amassed large profit through the international trade of saltpetre. There was a great

demand of Indian saltpetre in Europe and Asia particularly at the time of war. Bihar saltpetre helped the British in their war against Napoleon. By seizing Bengal, the British exerted mastery over 70 percent of the world's saltpetre production during the latter part of the 18th century. The heart of the Indian saltpetre production was Bihar.

Methodology

The present research was conducted with the help of source materials preserved in the State Archives of West Bengal and the National Archives, Delhi, the Asiatic Society of Bengal, the National Library. Francis Buchanan's Purnea Report, and Patna – Gaya Report were very much helpful for my study. I have used report from Select Committee on the Affairs of the East India Company. Proceedings of Vice-President-in-Council of the Revenue Deptt and Home Deptt. Public Consultation have been useful for the proposed research. Patna Judge Court Records were consulted. Apart from this, some important primary sources like H.T. Wilson's Review of the External Commerce of Bengal and Milburn's Oriental Commerce have been consulted. I have much

benefitted by consulting some valuable articles as primary sources. I have also used some articles and books as secondary sources.

CHAPTERISATION

The dissertation has been divided into six chapters.

Chapter – I : Historical Background of Saltpetre in India.

This brief chapter has tried to trace the history of saltpetre trade in India from 13th to 18th century. The chemical name of saltpetre is potassium nitrate (KNO_3). It is an essential ingredient for making gunpowder. Indians had perfected the method of preparing potassium nitrate. India was the largest gunpowder source in the world. Indian knowledge of saltpetre can probably be traced back to Antiquity when magicians, priests and artisans used it to make naphtha. Textile makers and metallurgists also used saltpetre in their trades. A large number of historians believe that gunpowder was invented in India and brought by the Saracens from Africa to the Europeans who improved its manufacture and made it available for war like purposes. Although Needham credits China with the invention of gunpowder it cannot be

accepted because 100 years before Needham, India's pioneering status in saltpetre was a common knowledge. Needham's pro-China view may be ignored by the evidence of Jean Baptise Tavernier, who recorded a local tradition in 1660's that gunpowder and artillery were first invented in Assam from where they spread to China. Tavernier mentioned that the Mughal general, who conquered Assam, brought back numerous old iron guns captured during the campaign. China developed fireworks, rockets, and other incendiaries rather than short firing artillery because China relied on artificial saltpetre for making gunpowder. The Chinese also often used a higher proportion of charcoal and suffar, which resulted in more fire and less ballistic strength. India, on the other hand, produced saltpetre of very high quality, enabling the development of gunpowder weapons, in particular heavy siege guns. In many ways, Indian gunpowder making was more advanced than that of China, particularly regarding the strength of the final product, in its commercial organization, and in its application to military purposes. Compared to China's paltry production of gunpowder, India's widespread and organized gunpowder production

system points towards indigenous development. Unlike China, the entire saltpetre industry in India remained unrivalled in the history of the world.

As early as 1460's nearly forty years before the commencement of the East India trade, the rulers of Jaunpur and Bengal already had organized saltpetre production as state monopolies managed by their chief merchants. In the 16th century there was a growing Portuguese interest in Indian saltpetre. A commercial treaty of 1547 between the Portuguese and the rulers of Vijaynagar mentioned the exportation of saltpetre from the latter's territory to Goa. Saltpetre was the first Indian ocean commodity which was globalised by the Portuguese. The Mughal Empire has been styled as "gunpowder empire", although this characterization is debatable. The guns were important for Mughal rulers as occasional instruments of imperial power. The victory of Babur over Ibrahim Lodi in 1526 was oftenly attributed to his use of artillery. After the battle of Panipat (1526), the first Mughal emperor ordered executions by firing squad. Babur's eldest son and successor, Humayun was keen to bring the Turkish artillery expert over to

his side. The widespread use of firearms by Sher Shah during the brief Sur interregnum was significant. The fact was that Sher Shah himself was killed by a gunpowder explosion. The early 16th century, for India, was time of significant military change, a watershed between the age of blade and the age of gun. Akbar made effective use of the new gunpowder weaponry in his many battles and campaigns. Sometime between the 1580's and the latter years of the reign of Jahangir, the Mughals established control over saltpetre production. The Dutch and the English appeared on the Indian scene after 1600. With their arrival, a much clearer documentation of the saltpetre trade emerged. The Dutch and the English merchants came to India seeking high-value, low-bulk luxury goods, but a few years experience taught them that saltpetre trade was a successful stable long distance trade in Asian luxuries. The Stuart dynasty in England encouraged the London-based Company to find out an alternative source of saltpetre. Between 1601 and 1801, ships made thousands of voyages carrying goods from Asian ports to the primary markets in Amsterdam, London, Copenhagen, Lisbon and Stockholm. Sometimes saltpetre was shipped in

heavy bags, weighing between 150 and 170 pounds that looked like mud and smelled like sewage. The Portuguese settlers at San Thome traded in saltpetre on a large scale in 1690's. Due to growing importance of saltpetre as a warcommodity and the French Revolutionary war in Europe in 1790's, the East India Company imposed monopoly on manufacture and trade of saltpetre in 1793. After obtaining this vital monopoly, Britain protected this. Saltpetre exports were banned. Thus an ancient Indian technology was harnessed by the English to subjugate the Indian. Greater access of saltpetre to the British and with the shutting out of other European powers, saltpetre became essential for other European powers, because the English had it. It became rare, as the English monopolized the trade. On the back of Indian gunpowder factories, Britain became pre eminent power in the world.

Chapter II : Methods of Manufacturing Saltpetre in Contemporary European Countries.

This chapter tries to explore the mechanism of saltpetre production in some European countries like France, Russia, Sweden and Switzerland which produced saltpetre. In producing this commodity these countries also took the advantage of environment. However, their dependence on environment was partial, whereas India and particularly Bihar depended totally on environment. These European countries undertook various methods in preparation of mould of black earth. In France, the preparation of Saltpetre was set on foot at once in three different stages (1) by the collection of already nitrified earth; (2) by the making of nitre-beds from already formed black earth; (3) and by the preparation of black earth. In Russia, five parts of black earth and one of spent ashes or broken mortar were mixed with barley straw, to make the mass porous. The mixture was then made into heaps six feet high and fifteen feet long with one side perpendicular (walls) and the opposite side sloping

regularly by a series of terraces or steps. The Swedish method did not differ in any essential respect from those which had already described. First a clay floor was prepared and upon this was placed a mixture of earth, mould, spend ashes, animal and vegetable refuse of all kinds. The process was precisely the same as the French, except that the process of preparation and nitrification were not separated. The method practiced by the small farmers in Switzerland was very simple. As table with a board floor was built on the slope of a hill. A moderate sized stable yielded with every leaching about one thousand pounds of saltpetre.

This chapter analyses the process of nitrification, leaching, conversion, refining and crystallization before the finishing of production of saltpetre. When the process of nitrification was complete, the earth of the heaps were leached. The same earth was leached repeatedly. The ley thus obtained were used on fresh earth. The ley contained nitrate of potash (nitre), nitrate of lime and magnesia, chlorides of sodium and potassium. The next process was to convert all other nitrates into nitrate of potash.

This was done by adding wood ashes. The ley thus converted was then poured off from the precipitate, into copper or iron boilers, It still contained common salt (chloride of sodium) in considerable, and some other impurities in smaller quantities. There was still another process i.e., that of refining, by which the whole of the impurities were removed. One hundred gallons of water was poured into a boiler, and crude saltpetre added from time to time, while the liquid was heating, until four thousand pounds were introduced. This would make a saturated solution on nitre. The nitre was now dried by gentle heat and constant stirring, and might be considered quite pure, and fit for the manufacture of gunpowder.

Chapter III : Environmental Deposit of Saltpetre

This chapter gives an interesting account of the method of the collection of raw materials for making saltpetre. The saltpetre workers were called as Nunias. They collected raw materials by three different methods. In each method their main attention

was to collect raw materials impregnated with nitre without which making of saltpetre was impossible.

First Method : Impact of Nature and Environment

In the collection of raw material, the first method was totally depended on environmental situation because it was formed by dint of nature. It was naturally produced. The Nunias collected raw materials from old mud walls of the villagers. During a particular season, specially in winter or in the month of November, a laire of nitre, essential for saltpetre making, were usually stored on these walls due to ecological factors of a particular geographical area. Purnea and Tirhut were particualtly important for collection of such type of raw materials. In the month of November, the Nunias commenced their operations by scraping the surface off from old mud heaps, mud buildings, waste grounds where the crude saltpetre was developed itself in a thin white efflorescence, resembling forest rind. In Tirhut, Saran, Patna, Gaya, Monghyr, Bhagalpore and Purnea,

saline matter was found in the neighbourhood of old houses and also in old mango groves. The formation of raw materials in these places depended on dry weather. It was again reappeared quickly. Therefore the Nuias had to scarp it again and again resulting in collection of a large amount of raw materials. There was a definite connection between the natural production of nitre and the state of atmosphere. The efflorescence took place only in the exterior of the wall. A frosty, clear and dry state of the atmosphere was particularly favourable to the natural production of nitre.

Second Method : Impact of Cow's Urine

The Second method was very interesting. According to Francis Hamilton Buchanan, the raw materials for production of saltpetre were also collected from specific type of soil impregnated with cow's urine. The soil were of three types – black, yellow and white. However the black soil was mostly favoured. To assemble a large number of cows was

problematical. During the whole season, where the soil was favourable and wherever cows were kept, it effloresced on the surface. The only thing required was a dry soil, which prevented the animal matter from being suddenly absorbed.

Third Method : Impact of Earth or Soil

The Nunias also collected raw materials from the earth or soil by building up farm yards. Between the middle of July and the middle of September, they repeatedly ploughed a plot of ground, threw on its surface all earth, from which saline matter had been separated by filtration. This earth was called 'Sithi'. They then daily collected as many cattle upon the plot as they could and kept them there as long as possible. About the end of October the nitre began to effloresce and the surface of the plot might be scraped once in four days, as long as the fair weather continued.

Chapter IV : Technology in Making Saltpetre :

This chapter provides a detailed description of the technology followed by the Nuniyas in making saltpetre. After collection of raw materials the next important task of the manufacturers was filtration and boiling which ultimately produced crystallized saltpetre. This chapter tries to analyse separately the description of Buchanan and Stevenson, two contemporary British writers, regarding system of filtration and boiling. At the same time the system has been discussed from the writings of the chemists. This chapter gives a description of filtration, boiling and crystallization by the chemists based on chemical analysis. Finally this chapter has dealt with various by-products of saltpetre refineries. Piddington's description about by products has been carefully analysed in this chapter. But the technology followed in performing this crucial task was very much indigenous. The whole operation of filtering and boiling was performed in the open air. The filtration was done by a large mud filter. It was a round hollow

basin in shape resembling the top of a well from 6 to 8 inches in diameter. The brine procured by filtering water through earth was called 'Ras'. The second process was to evaporate the saltpetre liquor to a crystallise state by boiling the brine. The boiling continued till the liquor was evaporated to a crystallising point. Henry Piddington had described and analysed about two by products of saltpetre – Puckwah and Phoolkharee salts. The puckwah was mostly produced during the manufacture of saltpetre and was sold openly in the bazaars for culinary purpose. The phoolkharee was manufactured from the efflorescence of the surface of various earths and was sold for feeding the cattle. There were three varieties of phoolkharee salt. One variety was used for the purpose of adulterating government salt. The fact is that the puckwah and phoolkharee salt were used for adulteration. The Government appointed chemists to detect the percentage of adulteration of these two salts with the good saltpetre. From the reports it was found that a section of Nunias produced this Kharee salt for adulteration and also for feeding the cattle.

Chapter V : Condition of the Saltpetre workers (Nunias) and their Resistance to British Monopoly :

This chapter describes the poor condition of the Nunias or the saltpetre workers and their attempts to make themselves free from various types of oppressions. Under the British monopoly their remunerations were reduced to a large extent. They had to pay different types of selamis to the government officials. The economic condition of the Nunias was depended on the demand of saltpetre. In war time there was a great demand of saltpetre. At that time they were economically benefitted. But in time of absence of war, many nunias were bound to become idle. Many of them were thrown out of employment. Not only that the Nunias were forced to supply saltpetre on a very reduced price to the Company's officials. The Nunias of Saran, Champaran, Tirhut, Patna Gaya and the Beldars of Purnea ordinarily received advances from the Company's officials for smooth running of their business. But sometimes these officials with

connivance of the Mahatos stopped payment of these advances to the Beldars and the Nunias. This deprived them of their means of subsistence. In 1802 the Nunias were forced to supply saltpetre on a very reduced price to the officials of Singhia, Muzaffarpur, Kurhani, Darbhanga, Mau, Chapra, Dighware and Dumri factories, those were the largest saltpetre depots in North Bihar. These poor and helpless manufacturers of saltpetre were employed by the Company and they were prohibited from working for any other person. From the beginning of the season, the Nunias were subjected to numerous under exactions. They had to pay to the Government half of their produce as sayer or tax for the manufacture of saltpetre out of which one fourth was paid to the Zamindars on whose estates the Kuthis or saltpetre factories were situated. The Numias had to pay selami and russom to the Kuthi officials under the following demonations : Moostajeer –Re 1-0-0, Canongo Rs. 1-8-0, Zilladar – Re 1-0-0, Barmottar Re 1-0-0, Malerna – Re – 1-0-0 and Paulsan Re 1-0-0. The mode of weighment was also very much objectionable. Due to over weighment the poor manufactures were put to a great loss. In 1811 they

presented a petition to the Court setting forth, in detail, the hardship they were exposed due to excessive rate of pusseree and unfair weighment. After 1800 due to increased demand of saltpetre in the English market the Nunias of Bihar were forced to accept advances on account of the Company. After the re-establishment of monopoly, the practice of forcing advances to the nunias continued. Besides, the price given to the nunias for their hard earned saltpetre was extremely low which was not sufficient for their subsistence. The records of the period disclose that for one maund of saltpetre, the Nunias were given only one rupee and six annas. Due to this unremunerative price the Nunias used to sold a portion of their produce to private merchants. In 1814 the Nunias of Bihar submitted a petition to the Board of Trade praying for an increase in the price of the article. Another petition was submitted by the Nunias of Bihar which stated that the remuneration given to the manufacturers was extremely poor. The corruption of the Company's indigenous servants and the oppressions to the Nunias were very much usual under the monopoly system.

Chapter VI : Saltpetre Trade in India in Pre-Monopoly period and in the Bengal Presidency in Monopoly period under the East India Company :

This chapter focuses on the Saltpetre trade in the Bengal Presidency in pre-monopoly and monopoly period of the East India Company saltpetre was extensively used in pre-colonial India. Patna, Golkonda, Surat, Masulipatam, Agra, Ahmedabad were important trade centres. In the first half of the 18th Century or before the establishment of the British monopoly, the saltpetre trade was mainly dominated by the English, the French and the Dutch. After the installation of Mir Jafar as the Nawab of Bengal, the English established absolute control over saltpetre trade in the Bengal Presidency. The English East Company established their monopoly in saltpetre trade on 11th June, 1793 During Company's monopoly the volume of trade and production of saltpetre varied according to the needs or situation of the war.

This chapter tries to indentify the nature of saltpetre trade in the Bengal Presidency in the pre-monopoly period. In the first half of the 18th century there was co-existence of competition and co-operation between the Dutch and the English in saltpetre trade. But when Robert Clive came into the picture in 1750's, the East India Company had dominated the saltpetre with the help of Nawab of Bengal. This chapter also highlights the nature of saltpetre trade of Omichand and Deepchand, two influential indigenous merchants, who had business with the Dutch and the English. This chapter also tries to assess the impact of French Revolutionary war in Europe in 1790's on the saltpetre trade of the Bengal Presidency. The East India Company was compelled to establish monopoly on production and trade of saltpetre due to war exigency. There was a tremendous pressure from the court of Directors of the East India Company to supply large quantities of saltpetre from the Bengal Presidency as quick as possible. There was an increased demand for saltpetre in the British market. The Company tried to prevent the foreign nations from receiving a greater quantity of saltpetre from the Bengal Presidency. In

1793 the Court of Directors demanded for supplying more than 400 tons of saltpetre in any of the early returning ships. This chapter also tries to make an estimate of the volume of trade of the East India Company in the Bengal Presidency.

Use of Saltpetre for various purposes

Saltpetre was a kind of artificial salt prepared from nitrates, found from time to time in a natural state in many parts of the world , chiefly South America Persia, Spain , Hungary and southern parts of Europe, China and India. It has been used extensively for different objects as an ingredient for gunpowder, in animal dyes for medicinal and antiseptic purposes like preservation of fish and meat, and embellishing and food preparations for manure, especially of wheat and tobacco, and in glass making, bleaching, washing and cooling purposes ¹

In the writings of the European travellers, merchants, and agents of the 17th Century, we do not however , get any reference to all these specific uses made of saltpetre, except as an ingredient for gun

powder, as a ballast for ships and for cooling purposes . The origin of the trade in saltpetre as an ingredient for gunpowder must, as Moreland remarked, be sought in the military history of Europe .

The practice of the English of using saltpetre as ballast in place of stones was borrowed from Dutch precedents .

On March 29 ,1644, the English East India Company ordered the Surat factors to include 20 or 25 tons of well refined slatpetre for kintlage or ballast.

Apart from the external use of saltpetre there was also an internal consumption of it in India . In the 16th and 17th centuries it was used here as a refrigerating unit, for cooling drinking water or any other liquid and as an ingredient for gunpowder and for the preparation of explosive and fireworks. We find in the Ain-I Akbari: "Saltpetre which in gunpowder produces the explosive heat is used by His Majesty as a means of cooling water and is thus a source of joy for great and small."² This seems to be corroborated by the statement of Peter Mundy (1632) that water

and other drinks were cooled in the summer with coarse saltpetre , by continually stirring the vessel of fresh water or other liquids in a kettle containing a mixture of water and saltpetre. ³ But the poor people could not afford to enjoy the luxury of using saltpetre for cooling water. Cooling was done by placing a wet cloth on a jar while the rich people made use of saltpetre , whether in town or with the army.

Thus, in one tent in the camp of Aurangzeb, were kept the Ganges water and the saltpetre with which it was cooled. It is interesting to note that the English factors at Agra also used saltpetre for cooling their water in the 17th century. With coarse saltpetre the charge in one year was Rs 49-50 pice, and with refined saltpetre it was Rs107-63 pice in another year.

Centers of Saltpetre Manufacture

According to geologists the necessary conditions for the formation of saltpetre in a soil are i) supplies of nitrogenous organic matter ii) climatic conditions favourable to growth and action of

nitrobacteria iii) the presence of potash , and iv) meteorological conditions suitable for the efflorescence of the potassium nitrate at the surface . To a large extent the existence of natural facilities would indicate the principal centres of saltpetre supply and manufacture . These facilities are found in a marked degree in different districts of the Indo - Gangetic tracts especially the Bihar section-Patna , Gaya , Tirhut Saran, and Champaran But as contributing to national defence saltpetre had always claimed attention of different governments and so political exigencies also determined the working of other centres less favoured with natural resources . Thus it was essential that the different states of India should have their local sources of supply , which were sought to be tapped by the European companies for their own States .

Centres of saltpetre manufacture were widely distributed throughout India . In Peninsular India saltpetre was found both in the East and the West coastal regions with their corresponding hinterlands. Thus Golkonda was also noted for its supply of saltpetre which was regarded as good as Surat.

In the Coromodal Coast the principal ports of export of saltpetre were Masulipatam , Armagon and Pulicat. The existence of Armagon and Pulicat shows that the corresponding hinterland, the Carnatic, was an important source of supply of saltpetre . There were many references of Pulicat gunpowder which was used by the Dutch⁵.

In the West, Bijapur had a plentiful supply of unrefined saltpetre, chiefly at Rawbag and round its neighbourhood and in the Konkan, and the corresponding port of Rajapur.

In Gujrat the region around Ahmedabad and the neighboring state of Malpur, and in the Indo-Gangetic plains, Sind, the regions around Agra , Bengal and Bihar, were all associated with the production of saltpetre throughout the 17th century in a varying degree of importance . The Gujrat region, though geographically separate, had a very intimate commercial contact with Agra .

Malpur was a small state in Mahikantha

situated nearly 50 miles northeast of Ahmedabad . As the English factors felt much difficulty in procuring saltpetre in Ahmedabad in 1643, they tried to tap Malpur for the first time in 1644, as a possible source of better and cheaper unrefined saltpetre.

The local agents of the English tried privately to induce the 'Bohras', the peasant cultivators of Gujrat who prepared saltpere, to allow them to share with the Dutch who had been tapping Malpur for some time past.

In the 17th century Agra was one of the principal centres of supply of saltpetre and manufacture of gunpowder . Pelsaert, the Dutch factor at Agra from 1620-26, wrote that saltpetre was found in many places near Agra at distances of 10 to 40 kos and the amount available every year in Agra alone was from 5000 to 6000 maunds, besides the produce of other neighbouring places . ⁶ But according to Peter Mundy (1632-33) the only place near Agra where salpetre was made and sold was Shawgur (Shergarh).

Tavernier mentioned that saltpetre came in abundance from Agra besides Patna.⁷

As for Sind, during the 17th century three places were connected with the production of saltpetre there, Tutta (Tattah), Naserpore or Nasarpur and Kandiaro, the first one being the market of saltpetre prepared in the other two places But saltpetre made at Tattah was referred to in 1635 as being very good .⁸

Attempts were sometimes made to procure saltpetre from Sind. In 1639 the Surat factors had an offer of cheap and good saltpetre from Sind .

But Sind went into the background as Bihar acquired prominence, and as about this time Patna was being regarded as a principal source of supply of saltpetre.

Well refined saltpetre – and plenty of cheap and good saltpetre was then procurable in Bihar .

The Bihar section of the Indo-Gangetic region,

chiefly Patna and Saran, was in the past an important centre for the production of saltpetre. Curiously enough , Bihar came to acquire prominence only in the second half of the 17th century.⁹

Whatever might have been the importance of Bihar under Afghan rule, the Mughal government drew its supplies from non-Bihar sources, especially from Agra and Ahmedabad and neighboring regions, for its own military purposes and that it had not tapped Bihar for saltpetre probably on account of distance and difficulties of transport. Hence Bihar Saltpetre came to be used if at all for local purposes only and could not acquire the high standard of being used as an ingredient for gunpowder .Thus the dormant potentialities of Bihar as a source of supply of first class saltpetre were worked up only as a result of foreign reconnaissance, access and demand. Then the importance of other centres diminished and Patna was generally acknowledged to be the best place for procuring saltpetre.

The Surat factors of the Company expected from Sind only well refined salpetre as saltpetre of

good quality was available in Bihar at comparatively cheap price . Bernier wrote: “Bengal is the principal emporium for saltpetre. A prodigious quantity was imported from Patna.”

Hence it is not surprising that the French, the Dutch and the Portuguese had factories at Patna. The English factory at Patna was of somewhat later date .

The Dutch Company had an establishment there on account of the trade in saltpetre which was refined at a large village called Chapra and the Saltpetre refined there was sent by river at Hugli.

Alexander Hamilton (1688-1723) also noted that at Patna the English and the Dutch had factories for saltpetre . The factories were utilised for procuring saltpetre till late in the 18th century .¹⁰

A factory was established at Patna in 1659. Job Charnock was the chief of this factory from 1664-80. His vigorous superintendence largely accounted for the progress of the saltpetre trade of the English . Thus we find that in the last quarter of the 17th century

the Court of Directors continuously demanded saltpetre from Patna.

In 1674, the agent at Hugli received orders to keep the saltpetre men constantly employed so as to have a stock always ready for shipment.

Another place of saltpetre production was “about 15 or 16 miles to the westward of Singee.” Patna was the principal centre of supply of saltpetre from neighbouring parts. Hugli, Balasore and Pipli were the chief ports of its export. The whole amount of saltpetre collected at Patna was sent to Hugli in great flat bottomed vessels of an exceedings strength, called Patellas, each brining down 4,5,600 Bengal Maunds or about 200 tons.

From Pipli the Dutch used to export in the middle of the 17th century about 2000 tons of refined saltpetre. In March 1683 Hedges attempted to build a saltpetre godown at the Bankshall , 7 miles from Balasore .¹¹

Variation of Prices of Saltpetre

The price of saltpetre varied from place to place and in the same place in different circumstances. Generally speaking saltpetre was considered to be an expensive commodity.¹²

In 1640, Vithala Gomti, the Rajapur broker of the E.I.C., sold 250 candies (125000 lbs. Or 5000 mds.) of saltpetre at $8\frac{3}{4}$ pagodas (Rs. 30 loas.) per candy at Raybag i.e at Re. 1-8 as -6 p. a md. of 25 lbs. In 1648 as the cost of refining saltpetre at Raybag proved excessive the remaining raw saltpetre was refined at Swally; but the “cost of the lot worked out at $4\frac{1}{2}$ rupees the maund, which was much dearer than the saltpetre brought at Agra and Ahmedabad.”

In November 1644, the Malpur saltpetre was better and cheaper than the Ahmedabad and the raw saltpetre at Malpur cost no more than 4 and 4 % rupees for 5 double maunds” (=5 x74 lbs). But the

excessive charges of transport to Ahmedabad more than doubled the prime cost. In March 1647, the E.I.C.'s officers made an agreement for 1,500 great-maunds of saltpetre at 22 rupees per maund, which was one-eighth dearer than last year, this was due to the high cost of transport, owing to the lack of water and grass caused by the drought.

In December 1635, the saltpetre made at Tutta (Tattah) in Sind was very good but very dear, costing Rs. 6 a maund. In March 1665, saltpetre brought to Surat was sold at a high price, the minimum being Rs. 4 ½ a maund. ¹⁴

There were wide variations in prices of saltpetre at Ahmedabad in 1628 during such a short time as about three months. In January 1628 the price of first class saltpetre was Rs. 2 % a maund, while by end of March it fell down to Re. 1 Vz. In other words, the price was determined by the limited supply, by the Anglo Dutch competition for demand, and also by the restrictions put on by government on clearance of saltpetre. ¹⁵

In December, 1650, saltpetre was plentiful and cost at Patna only Re. 1 a maund and at Hugli Re. 1-12 including customs and freight charges. During 1651-4, the price of saltpetre at Patna was generally about half of that at Balasore. About 1665-70, the saltpetre of Patna was cheaper than on the West Coast, and at Masulipatam. But the price at Patna rose from Re. 1 a maund in 1650 to about Rs. 2-3 as- 2 ½ p. in 1679.

Nature of Mughal Monopoly

Saltpetre was a state monopoly during the Mughal rule. The purchasers in all places paid some acknowledgement to the Governor of the place where it was bought.¹⁶ The seller had to pay to the king a duty of 1%¹⁷ The English could take no more than what was necessary for their “occasions”, and “none for their merchandise.”

Sometimes in Allahabad the English were not allowed to purchase any saltpetre ‘in this kingdom,’ or to procure the stipulated amounts from the saltpetre manufacturers.

State control was exercised in three ways ; -
(a) claim of purveyance or pre-emption, as shown in control of production, refinement and purchase of saltpetre, either for military or non-military purposes, (b) control of unlicensed purchase and transport, (c) occasional revocation of provincial government's orders.¹⁸

The Government had claim of purveyance or preemption in saltpetre. No reasonable objection could be taken to the government claim of monopoly for its military needs. Thus in 1629 Shahjahan forbade saltpetre to be bought at Agra till he had been supplied with 10,000 mds. of powder ordered to be made there. Similarly, the necessities of the N.W. Frontier and Central Asiatic wars (1647-48) led him to strictly inhibit the export of saltpetre and his officers prohibited "boiling for any but the King's government."

This sort of control was exercised not only by the emperor, but also by the provincial governors for their own wars. As a result of need during the Mughal invasion of Golkonda, prince Aurangzeb might be expected to capture saltpetre caravans going via

Burhanpur. The amount collected so far might be detained neither at the place of manufacture nor at Agra, and might be removed to Ibrahimabad near Biana. Towards the end of 1657, Murad Bakhsh forcibly seized from the English the saltpetre, provided by particular persons at Ahmedabad, probably for his military preparations for the War of Succession. The English thought it unsafe to count upon procuring any goods from Ahmedabad in time of dispatch by the next fleet.

Government control was exercised also for nonmilitary purposes. In 1646 Aurangzeb, the then Governor of Gujrat, probably under the influence of ulemas or theologians, prohibited the sale of saltpetre to the English, because gunpowder made from Indian saltpetre not be used against a Muslim power. This was regarded as a somewhat unusual and 'unexpected impediment' to the English factors.

However it was nothing but a temporary obstruction, as it disappeared with Aurangzeb's transfer. Again, in 1689 at the request of the Sunni Sultan of Turkey, Aurangzeb forbade the sale of

saltpetre to Christians, as it was often used against 'good Muhammadans'; and the English lost for a while their saltpetre trade at Patna.

Unlicensed purchase and transport of saltpetre by the English or the Dutch were also forbidden by the Mughal State. There English factors, Gregory Clement and John Bangham, were imprisoned for a day and a night in the Agra castle; and that after making enquiries the emperor gave license. In 1646 also the caravan carts of the English Company were detained. In 1654 Shahjahan's Diwan prohibited buying and transporting saltpetre from Ahmedabad. In December 1655 the permission to send away the caravan of goods from Ahmedabad and Agra was secured from the Diwan Rahamat Khan.

The royal fiat could at any time overrule local governor's permission to trade in saltpetre. In 1654, Murad Bakhsh, as governor of Ahmedabad, had permitted the English to buy as much saltpetre as they wanted. But when part of it was received and being refined, the king's Diwan sent an order prohibiting them from buying or transporting any

saltpetre from Gujrat, and the embargo could not be removed.

The Mughal government occasionally farmed out the saltpetre manufacture to particular persons, as for example, Mir Musa got such a farm in Gujrat in 1646. But the farmer had no right to grant dastaks or license.

Besides seizing saltpetre for local military needs, the provincial governors and Diwans also endeavoured to establish their own monopolies in this article. During 1660-61, the Diwan of Patna, Mirza Lutfullah Beg, attempted to monopolise the sale of saltpetre for the benefit of the imperial revenues. He forced the dealers, inspite of their contracts with the Dutch, to deliver their saltpetre to him. The Dutch, whose Director Matheus Van den Brock at Hugli, complained to Mir Jumla, alleging that these actions were secretly instigated by the English factor at Patna, Chamberlain and his broker, Ganga Ram, who had promised to purchase saltpetre from the Diwan. The Agent of the English, Trevisa, disclaimed these allegations and agreed with the Dutch Director not to

deal with the Diwan and not to purchase saltpetre except as before i.e., directly from the dealers. Moreover as Mir Jumla sent a parwana to Lutfullah, forbidding him to hinder the Dutch, who had assisted the Governor in his operations against Bahadur Khan of Hugli, from trading freely in saltpetre. It was expected that the Anglo-Dutch dispute would be settled. But afterwards, Chamberlain was accused of trying to buy saltpetre from the Diwan, secretly in violation of Trevisa's agreement.²⁰

Shaista Khan, as governor of Bengal (since December 1663), also tried to monopolise the entire saltpetre trade in his own hands and then to sell it to the English and the Dutch 'at his own rates', as he knew that their ships could not go from the Bay of Bengal empty. In 1664, his darogha or agent came to Patna with a commission to buy 20,000 mds. of saltpetre, and ordered to prohibit the Dutch and the English from advancing any money to the manufacturers. He prevented the English from weighing and receiving the stipulated saltpetre from them, and put his 'seal on the several places of production'. So great was the oppression of the

daroga as on the manufacturers and merchants that they used to run away daily without fulfilling their contracts to the English Company and so the English factors feared that the Nawab would not be able to procure more than four to five thousand maunds that year. On the other hand, Shaista Khan demanded to the English 20,000 mds. on the pretence of “buying for the king” and of “carrying on the king’s wars” i.e. Arakan Wars.

Monopolies of saltpetre existed also in the Golkonda and Bijapur states. The Golkonda state wanted to control the production and trade of saltpetre for military purposes.

As a result of Aurangzeb’s wars with the Golkonda king, the latter had monopolized all available saltpetre from the producers, including a large part of what the East India Company had contracted for over two years and already secured. Besides, fresh sales to others were also stopped. Similarly the king of Bijapur claimed a monopoly of saltpetre there and he farmed it out to any contractor who offered a large sum.²¹

The result of the government control on the organization of the saltpetre industry, was as follows
(i) The manufacturers did not keep any saltpetre in stock beforehand, and hence it took some time before raw saltpetre could be produced and refined, (ii) The manufacturers did not contract with the English factors except on such terms as would cover their expenses, (iii) The English factors had to suffer troubles to clear the saltpetre from the king's ministers, (iv) There was a corresponding rise in price of saltpetre.

But the monopoly was at times evaded in actual working. The producers and purchasers, who suffered on account of it, naturally tried to get rid of its rigours, and the state officers also were sometimes seduced by the lure of private gain. Thus in March 1628, with a 'little judicious bribery' and present to the royal representative, the English factors were released from prison, and were licensed to purchase an additional quantity of 2000 mds. of saltpetre and their caravan was allowed to proceed. Similarly in 1647, the Agra factors hoped to procure saltpetre (in spite of monopoly) easily by corrupting with small

bribes. In 1666, inspite of government monopoly in Golkonda, the English factors were sanguine of suddenly clearing their amount which had been seized by the government.²² Occasional evasion of authority, was however at best only a negative and immediate remedy. A positive and a more permanent remedy was felt necessary and in Golkonda the factors of the English Company tried to secure a monopoly of saltpetre trade; while in Bijapur, they tried to secure a partial exemption from customs on any saltpetre they might buy in future.

In Bijapur, the English E.I. Company's factors attempted to procure the remission of the duty on any saltpetre the English might buy in future.

Administrative Interference in the Saltpetre Trade of India under the Mughals.

Moreland had pointed out that saltpetre trade was subjected to frequent interference on the part of the Mughal authorities and such "official interference" was

one of the difficulties attending the trade.²³

In the first place, there was everywhere the tendency on the part of the provincial governors and the officials to interfere in the saltpetre trade, occasionally under the pretence of imperial orders, but often, on their own initiative - either by local extortion or by detention of saltpetre caravans of cafilas or boats. This evil was aggravated by the system of farming out saltpetre, which prevailed in Gujrat and Bijapur, in the middle of the seventeenth century. Owing either to practical abeyance or decline of imperial authority, the unrestrained subordinate officers became very exacting.

Secondly, administrative changes like new appointments and transfers of officials, etc, affected the course of saltpetre trade. The privileges granted by one governor were cancelled by his successor. Under efficient men like Aurangzeb, Shaista Khan, or Mir Jumla, the Company had to suffer numerous vexations.

Thirdly, to cope with the corruption of the high official like the Governor and to secure a royal farman for the release of their detained goods, the English had to spend money at the imperial court. They thought that it was better to spend money than to bribe the local officials, who were never satisfied.²⁴

Lastly, there was even no certainty that the royal mandate would be always obeyed. When in 1646 as Governor of Gujrat forbade the transport of saltpetre, the English factors at Swally Marine did not expect its speedy release. As the Emperor was far off at Lahore, and the Court was usually dilatory, it was impossible to get a timely redress.

Gujrat, in the middle of the seventeenth century was the scene of numerous administrative scandals. In the first place, it illustrated the evils of farming saltpetre. With Aurangzeb's transfer from Gujrat (1646), the English factors began immediately to prepare their caravan (cafila) and procure the licence for transport of saltpetre. It had then been farmed out to Mir Musa. He induced the English to believe that he had the authority to grant them the dastak or licence.

As a matter of fact, however his dastak proved useless. The English Company's carts were detained.

There were cases of disregard of a royal farman by the provincial Governor, Shaista Khan, the saltpetre farmer, and the Bakhshi. The stoppage of the Company's saltpetre by the Governor was not due to the pursuit of conscious policy of controlling its trade but to his motives of personal gain.

Early in January, 1653, two hundred bales of saltpetre were detained at Ahmedabad by the new Governor. The Surat factors came to realize that the saltpetre at Ahmedabad could not be released without offering a heavy bribe to the Governor. But they refused to give it for three reasons viz.; (i) there was little chance of shipping to England that year, (ii) the Governor, Shaista Khan was to be replaced by Prince Murad Bakhsh, and (iii) they daily expected a royal farman, ordering release of saltpetre detained at Ahmedabad and Patna as well. Even up to May 12, 1654, this expected farman was not obtained. This embargo could not be removed, inspite of occasional promises of removal.

The Agra region was not free from official interference. On December 12, 1648, Richard Davidge at Biana wrote to Surat that as he had been offered only half the value in compensation for the saltpetre forcibly taken by the king's ministers, he had delayed accepting it in order to extort better terms.

Interference of the Bijapur state officers similarly caused troubles for the English Company's saltpetre trade.

There was misgovernment in Bijapur and its adverse influence affect the course of trade.

Early in 1653 the Governor of Bihar refused to release saltpetre for export from Patna. Similar interferences were also made at Hughli. The Dutch too suffered and their factory at Pipli was burnt. At the end of 1654 a quantity of saltpetre was detained at Rajmahal for custom and it was not expected to reach Hughli till after the rains. In order to secure its release, and for future negotiations, the Balasore factors thought it essential to provide some considerable and valuable present for the Prince and other great men

yearly, especially as the Dutch gave largely. Again soon after Aurangzeb's accession (July 1658), Mir Jumla, the imperial general, became the Nawab of Bengal (1659-63), in place of Shah Shuja, and stopped all English boats laden with saltpetre, coming down the Ganges from Patna, at Rajmahal.²⁵

It appears from a study of English factory correspondence that Shaista Khan's regime caused numerous hindrances and interferences to the English Company's trade in Bengal.

The trade of Bengal had multiplied and Shaista Khan could reasonably demand customs from the English. But this is also true that the Company was subjected to occasional vexatious interferences, which evaporated only with handsome presents offered to the Nawab and his subordinates.

The remedies for release of saltpetre were "money", "presents" and "influence". English factory correspondence of this period was replete with allegations of covetousness against Shaista Khan and since no redress from him was possible without a

present to him and his chief servants the Bengal factors sent presents, worth Rs. 2,000 and more, to the Nawab.

The Bengal factors observed that since injustice was Shaista Khan's general exercise, it caused financial strain on the Company.

The English enjoyed privileges given by the Prince (Shah Shuja) and were confirmed by several rulers. Therefore the foreign companies customarily enjoyed privileges, granted by provincial governors, but not confirmed by the Emperor, and that the foreign Companies could use royal farmans as convenience dictated to them and thus deprived the provincial governments of legitimate revenue. So the economic interests of the country were frittered away by governors acting on their own initiative; and that the Mughal central government, by being unable to keep effective control over the tariff policy of its provincial governors, was guilty of a serious negligence of duty, alike from the administrative and the fiscal points of view.

The Company's enjoying privileges, not duly confirmed, was utilised by Shaista Khan as a lever and as a pretence for extortion (visits, presents etc.) Therefore the Bengal factors wanted the Surat factors to procure from the Emperor a confirmation of their long- enjoyed traditional privileges.

There are many illustrations of the influence of the local governors and their subordinates, when uncontrolled by their superiors, on the affairs of the English factory at Patna in the sixties and seventies of the seventeenth century.

Therefore saltpetre trade of the English at Patna suffered heavily.

The English Company wanted to build factory house outside Patna because it would be comparatively free from the local officials exactions.

The then Nawab of Bihar at first demanded Rs. 500 as peshkash to allow the English to open their warehouse and to grant a dastak for their saltpetre boats. But subsequently he fell off from his promise,

and demanded what other Governors had taken from the English before. Even after the payment of these, the promise was not fulfilled as a new Diwan came.

The Diwan permitted to open the warehouse, on three conditions : (i) the English to give a mochelka (bond) to secure from Delhi a written exemption from customs in two months, (ii) the saltpetre goods to be written down (iii) the customs be fixed at 5% and be deposited. Later on the Diwan relaxed his demands.²⁹

A change in the staff of the government necessitated fresh petitions, and numerous negotiations before a promise of parwana permitting the saltpetre boats to sail could be obtained. The Company's wakil, the Diwan, and his assistant, the Diwan's mansbdar, and the sealkeeper, the Kazi and the court inspector were all associated in this attempt of the English to secure the necessary dastaks, Bribes had to be given to these officers.²⁶

The appointment of new Governors was, as a rule, a signal for fresh extortions.

In the 70's of the 17th Century Ibrahim Khan was in charge of Bihar administration as the Deputy of Shaista Khan.²⁷ Due to excesses of Ibrahim Khan the English closed their Patna Factory in 1676 and lived in hired houses.²⁸ In November 1679, Job Charnock gave the Nawab a present of Rs. 2,000/- and Rs. 700/- to Mir Bahri (Lord of Admiral) and got clearance orders for the saltpetre boats to be dispatched to Calcutta.²⁹ After 1680 the Dutch became a crucial factor in the sea. They purchased huge quantity of saltpetre in Bihar and exported it to their home market.³⁰ In 1700, Murshid Quli Khan as Diwan of Bengal, tried to control the saltpetre trade of Bihar. During the period of Farruk Siyar (1712 to 1727) the Dutch became the principal trader of Bihar saltpetre. After the death of Murshid Quli Khan, his son-inlaw Shiya Khan ruled as the Nazim of Bengal, Bihar and Orissa till 1739. During this time there was a keen competition between the Dutch and the English in the field of saltpetre trade. After his death, his son Sarfaraz became Nawab of Bengal. But he was overthrown in 1740 by Alivardi Khan who ruled till 1756.

During the rule of Alivardi Khan, Patna had developed into a very busy centre of trade for saltpetre.³¹ By 1750, most of the saltpetre exported by the European companies was manufactured in Bihar.³² The Dutch and the French, who also had their factories at Patna, were the rivals of the English in the saltpetre trade. The Englishmen of Patna factory were involved in a quarrel with the Dutchmen regarding the purchase of saltpetre. But the dispute was settled amicably with the interference of the English President and Council at Calcutta. In 1740, more than 25,00 bags and 1742 more than 18,000 bags of saltpetre were sent to Calcutta from Patna.³³ In 1744 the English factory at Patna persuaded the Dutch and the French to keep down the price of saltpetre. Before 1757 the East India Company tried their best to gain absolute control over the saltpetre farmer in Bihar. The Company reached their goal on the occasion of a dispute between the servants of Khwaja Wajid, a saltpetre contractor, and those of the English Company's Factory at Patna. Clive took this opportunity to request the newly installed Nawab Mir Jafar, for granting the saltpetre farm to the English Company as the only means of preventing such

disputes in future. They offered the highest terms at which the farm had ever been rated. The Parawana ran thus : at this time through the means of Colonel Clive the saltpetre land of the whole province of Bihar have been granted to the English Company from the beginning of Bengal year 1165 in the room of Coja Mohawed Wazeed. You are therefore hereby directed to establish the authority of three Gomastas in all the saltpetre lands of the aforesaid province, to give strict orders to the saltpetre picars not to sell an ounce of saltpetre to any other person and to receive from the Company the stipulated nuzzerana and money for the aforesaid lands.”³⁴

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CHAPTER – 1

Historical Background of Saltpetre in India

Ancient and Medieval Period

The Chemical name of saltpetre is potassium nitrate. It is an essential ingredient for making gunpowder. Indians had perfected the method of preparing potassium nitrate (KNO_3). India was the largest gunpowder source in the world. India's military technology is history's greatest 'hidden' secret. Although Needham credits China with the invention of gunpowders it cannot be accepted because 100 years before Needham India's pioneering status in saltpetre was a common knowledge. A large number of historians believe that gunpowder was invented in India and brought by the Saracens from Africa to the Europeans who improved its manufacture and made it available for warlike purposes. Unlike China the entire saltpetre industry in India remained unrivalled in the history of the world. Compared to China's paltry production of gunpowder, India's widespread and

organized gunpowder production system points towards indigenous development. Needham's pro-China view may be ignored by the evidence of Jean Baptise Tavernier, who recorded a local tradition in the 1660's that gunpowder and artillery were first invented in Assam from where they spread to China. Tavernier mentioned that the Mughal general who conquered Assam brought back numerous old iron guns captured during the campaign. China developed fireworks, rockets, and other incendiaries rather than short firing artillery because China relied on artificial saltpetre for making gunpowder. The Chinese also often used a higher proportion of charcoal and sulfur, which resulted in more fire and less ballistic strength. India on the other hand, produced saltpetre of very high quality, enabling the development of gunpowder weapons, in particular heavy siege guns, in addition to rockets. In many ways, Indian gunpowder making was more advanced than that of China, particularly regarding the strength of the final product, in its commercial organization, and in its application to military purposes.

As early as 1460's nearly forty years after the commencement of the East India trade, the rulers of Jaunpur and Bengal already had organized saltpetre production as state monopolies managed by their chief merchants. The Mughal Empire had often been styled as "gunpowder empire", although this characterization is debatable. The guns were important for Mughal rulers as occasional instruments of imperial power.

Saltpetre had been used since the dawn of the civilization. Its combustible properties doubtlessly discovered by accident in ancient times. Before early modern age, saltpetre was mostly used for other purposes, i.e. non-gunpowder purposes, ranging from textile bleaching and tanning to soap making and metallurgy and also as a preservative by cheese and sausage makers.

Indian knowledge of saltpetre can probably be traced back to antiquity when artisans, physicians and others used this substance. In the mid-13th century the others used this substances. In the mid-13th Century the Mongols introduced the making of

fireworks to India. In the 14th Century the break-up of the Delhi Sultanate, the rise of regional states, the growing presence of Turkish mercenaries in India may be linked to the establishment of regular saltpetre production and the adoption of the use of gunpowder weapons. By the 15th century the area lying between Jaunpur and Bengal emerged as the premier saltpetre-producing region of India. The rulers of Jaunpur and Bengal had organized saltpetre production as state monopolies managed by their Chief merchants. Therefore, before the arrival of the European traders a pattern of capital investment, state control and labour organization was found in saltpetre production in Eastern India. In fact, India was roughly a century ahead of Western Europe in terms of developing the infrastructure for gunpowder technology. Before 1530's the Gujrati saltpetre was shipped from Cambay to Malacca and then carried onwards to Java along with other valued Indian commodities. In 1547 as a result of commercial treaty between the Portuguese and the rulers of Vijaynagar, saltpetre was exported from Vijaynagar to Goa. There was a growing Portuguese interest in Indian saltpetre.

Mughal Period

There was a steady development of saltpetre production in India under the Mughals. The guns were important to the Mughal rulers. The victory of Babar over Ibrahim Lodi (1526) is often attributed to his use of artillery. Babr's son Humayun, tried to bring Rumi Khan, the Turkish artillery expert who was employed by the Sultan of Gujrat over to his side. The use of firearms by Sher Shah was widespread. Sher Shah himself was killed by a gunpowder explosion. Akbar's advisor, Abul-Fazal adopted many of Sher Shah's innovations. Akbar's opponent Himu was a saltpetre merchant – turned – general. Akbar made effective use of the new gunpowder weaponry more so than his opponents. By the mid 16th century gun powder had become widely available in India, Sher Shah's infantry, carrying firearms, were recruited from the Eastern Ganges plain, where saltpetre production had become an important component of the regional economy. In Sher Shah's time, local officials had been ordered to purchase gunpowder from the public bazar.

It is significant to note that Abul Fazal did not mention about the saltpetre grounds of Bihar, although those certainly existed, in Akbar's time. Not only that in Akbar's time, saltpetre production and gunpowder making had yet to be brought under the purview of imperial officials and agents. Probably individual soldiers and commanders arranged the production of gunpowder as needed in Akbar's time. It is known from Ain-i-Akbari that the possession of firearms and powder making were decentralized in Akbar's empire. However, the Mughals demonstrated an interest in the technical aspects of saltpetre production and its use. But sometime between 1580's and the latter years of the reign of Jahangir (1605 – 1627), the Mughals established control over saltpetre production.

Late Mughal Period

In the late Mughal period Patna was one of the busiest marts in India for saltpetre trade. The Dutch and the English were the regular customers of the article. ¹ The export of Bihar saltpetre was an

important item of commerce in Mughal India. The Portuguese carried a considerable quantity of this article to Europe. However the production of saltpetre was carried on by artisans without superior capitalist direction.² Artisan system of production was prevailed in the saltpetre industry of Bihar. Advances were made to the Nunias from September to June. Permanent factories were established to deal with the Nunias. An important feature of the basic organization of saltpetre industry under the Mughals was the system of farming. The Mughals farmed out the saltpetre manufacture to a particular person. In the reign of Shah Jahan, Mir Musa got such a farm in Gujrat in 1646.³ Officers of the Mughal Government collected the saltpetre needed for its use in the battles. But the Provincial Governors and the Diwans established their own monopolies in saltpetre as a sources of their income. Since the beginning of the 17th Century the Dutch and the English had competed with each other for acquiring as much saltpetre as possible from the dealers. The British had the target to obtain saltpetre from Gujrat, Agra, Coromodel coast and the Konkan ports. Howver, in the early 17th century, the volume of trade of the British was

moderate i.e., 45 tons in 1625, 33 tons in 1639, 40 tons in 1643 and 25 tons in 1644. On the other hand, the quantities carried by the Dutch were much larger. Their yearly export between 1630 and 1650 ranged from 200 to 300 tons. ⁴

After 1650 Patna had developed into a place of a very considerable saltpetre trade. Its importance was due to the local manufacture of saltpetre. Financially speaking, saltpetre industry proved a poor to the province of Bihar. Since 1663 Shaista Khan as Governor of Bengal, monopolized the entire saltpetre trade and sold the commodity to the English, the Dutch and the French traders at his own rates. Shaista Khan caused various hindrances to English company's saltpetre trade in Bihar. Generally the Provincial governors interfered in saltpetre trade under the pretence of imperial orders or by local extortion and detaining the saltpetre boat's caravans. Sometimes privileges granted by one Governor were cancelled due to administrative change like new appointments and transfer of officials. But in spite of these interferences the saltpetre trade improved to a great extent. In the seventies of the 17th century

Ibrahim Khan was in charge of Bihar administration as the Deputy of Shaista Khan. But due to his extortion the English closed their Patna factory in 1676 and lived in hired houses. In 1700 Murshid Kuli Khan, as Diwan of Bengal, tried to control the saltpetre trade of Bihar. During the period of Farrukhsiyar from 1712 to 1727, the Dutch became the principal traders of Bihar saltpetre.⁵ Till 1739 there was a keen competition between the Dutch and the English in saltpetre trade. During the rule of Alivandi Khan Patna had developed into a very busy centre of saltpetre trade. Most of the saltpetre exported by the European companies was manufactured in Bihar.⁶ The Dutch and the French, who also had their factories at Patna, were the rivals of the English in saltpetre trade. In 1740, more than 25,000 bags of saltpetre had been sent to Calcutta from Patna. In 1741 the price of saltpetre rose to six rupees a maund due to disputes of the Dutch and the English at Patna. In 1742, more than 18,000 bags of saltpetre were exported to Calcutta from Patna. However the Maratha invasion through Bihar in 1743 hampered investment in saltpetre at Patna.⁷ In January 1745, the Patna factory sent 6,094 bags of saltpetre to Calcutta.⁸ However another Maratha

invasion took place in Bihar. In July, 1745 the Maratha invading army entered into the Province of Bihar via Patna and created fresh trouble for the English Company's saltpetre trade. The Marathas plundered Fatwa and burnt the saltpetre godown there. As a result 7,186 bags of saltpetre were destroyed.⁹ In 1748 the English sent home, 3,300 bags of saltpetre.¹⁰ In Feb. 1757 the Calcutta Council sent to Madras Council 600 bags of saltpetre.¹¹ The English were all these years trying to gain absolute control over the saltpetre farm in Bihar.

Situation in Europe

On the other hand, the gunpowder situation in Europe was grim. Saltpetre-based gunpowder was in constant short supply in Europe. However there was a great demand of gunpowder in Europe because it became an essential ingredient for subjugation of natives, extraction of gold, capture of territories and slaves and piracy on the high seas. Although in 1605, Spain was the prime power in Europe, the king of Spain sent a letter to the Portuguese Viceroy of Goa to send 10 or 12 caskets of saltpetre annually. The

establishment of British monopoly on production and trade of saltpetre in the Bengal Presidency had its serious effect in Europe. The British monopolized the saltpetre trade in Europe. There was a crisis of saltpetre in European countries. Saltpetre became essential for European powers, because English had it. France had already tried to discover the process of manufacturing saltpetre. In 1775 the French scientists proposed manufacture of saltpetre within France. In 1791 a factory was set up near Paris for manufacture of saltpetre. The whole of France was mobilized for saltpetre collection and gunpowder production. However, due to superior quality of Indian saltpetre, the British gunpowder was widely recognized to be far superior to the charcoal like French product. But France established large number of factories to overcome the British naval blockade. On the other hand, in the year before the Battle of Waterloo (1815), the East India Company exported 146,000 pound of saltpetre to England which was equal to 7300 tons of saltpetre. England produced 36,623 $\frac{3}{4}$ pound barrels of powder. Some of British munitions was supplied to allied government like Portugal. Spain and Sweden also received munitions for fighting on the British side

against Napoleon. The use of Indian saltpetre was an important factor for the British victory at Waterloo.

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CHAPTER – 2

METHODS OF MANUFACTURING SALTPETRE IN CONTEMPORARY EUROPEAN COUNTRIES.

In the 19th Century some European countries like France, Russia, Sweden and Switzerland produced saltpetre. In producing this commodity these countries also took the advantage of environmental situation like India. However their dependence on environment was partial, whereas India and particularly Bihar depended totally on environment. There were some similarities in mode of production of saltpetre in Bihar and European Counties, but the methods of production of this commodity in Bihar was different in many ways from the methods of production followed in European countries.

The general conditions necessary to the formation of saltpetre were 1st the presence of

decaying organic matter, animal or vegetable, especially the former, 2nd, an alkaline or earthy base, as potash or lime, 3rd, sufficient moisture; 4th, free exposure to the oxygen of the air, and 5th, shelter from sun and rain.¹

These conditions were often found in nature, as in the soil of all caves, but particularly those in limestone countries; and still more frequently under a concurrence of circumstances which though not strictly natural, was at least accidental, so far as the formation of nitre was concerned, as in cellars, stables, manure-heaps etc. In crowded cities with narrow, dirty streets and lanes, the decomposing organic matter with which the soil was impregnated became gradually nitrified, oozes through and dried on the walls and floor of the cellars, as a whitish crust, easily detectble as saltpetre by the taste. If the earth contained saltpetre in sufficient quantities, it must be leached, and the salt crystallized.

This could only be done by means of nitre-beds. ²

Nitre-Beds

The most important prerequisite in the construction of nitre-beds was a good supply of thoroughly rotted manure of the richest kind in the condition usually called mould, or black earth. To make the bed, a floor was prepared of clay, well rammed, so as to be impervious to water. An initiate mixture was made of rotted manure, old mortar coarsely ground, or wood ashes, together with leaves, straw, small twigs, branches etc. to give porosity to the mass, and considerable quantity of common earth. The heap was watered every week with the richest kinds of liquid manure, such as urine dung-water, water of privies, cess-pools, drains etc. The quantity of liquid should be such as to keep the heap always moist, but not wet. Drains, also should be so constructed as to conduct any superfluous liquid to a tank, where it was preserved and used in watering the heaps. The materials were turned over to a depth of five or six inches every week, and the whole heap turned over every month. This was not always done, but it hastened very much the process of nitrification. As the heap ripened, the nitre was brought to the

surface by evaporation and appeared as a whitish efflorescence, detectable by the taste. When this efflorescence appeared, the surface of the heap was removed, to the depth of two or three inches, and was kept outside under shelter, and kept the moist with water. The nitre contained was thus considerably increased. When the whitish crust again appeared, it was again appeared, and it was again removed until a quality sufficient for leaching was obtained. The small mould which was thus left was usually used as the nucleus of a new heap. By this method and abundant supply of nitrified earth, in a condition fit for leaching, might be obtained by autumn or early winter.

PREPARATION OF MOULD

The French Method

Systematic preparation of mould of black earth was undertaken. The process of preparation was precisely similar to that of compost manure, the chief difference being the greater richness in nitrogenous matter in case of compost intended for nitre-beds.

First a floor was prepared of well-rammed clay and on this place were kept a layer of common soil, mixed with broken old mortar or ashes, six or eight inches thick; then a layer of vegetable matter – straw, leavaes, rank weeds etc. then a layer of animal matter, dung, flesh, skin, scrapings of drains, sinks etc. then another layer of mixed earth and mortar or ashes, and so on until a heap six feet high was made. Brush and sticks were often introduced to increase the porosity of the mass. The whole was protected from the weather, and was watered every week or two with urine or dung-water, until the organic matter was entirely decomposed into a black mass. This would take place in about a year, or perhaps less, in France's climate. The whole was thoroughly mixed, and was then fit for making nitre-beds.

The preparation of saltpetre might be set on foot at once in three different stages of advance, viz. : by the collection of already nitrified earth; by the making of nitre-beds from already formed black earth; and by the preparation of black earth. By leaching, the first would yield immediate results, the second in six or

eight months, and the last in about eighteen months or two years.³

The Prussian Method

Five parts of black earth and one of spent ashes or broken mortar were mixed with barley straw, to make the mass porous. The mixture was then made into heaps six feet high and fifteen feet long with one side perpendicular (and hence called walls), and the opposite side sloping regularly by a series of terraces or steps. Straight sticks were generally introduced and were withdrawn when the mass was sufficiently firm. By this means air and water were introduced into the interior of the mass. The heap was lightly thatched with straw to protect from sun and rain. The whole was frequently watered with urine and dung-water. The perpendicular side being turned in the direction of the prevailing winds, the evaporation was most rapid on that side. The liquid with which the heap was watered was drawn by capillarity and evaporation to this side carrying the nitre with it, and the latter effloresced there as whitish crust. The perpendicular wall was shaved off two or three inches deep as often

as the whitish incrustation appeared, and the material thus removed was kept for leaching. The leached earth, mixed with a little fresh mould, was thrown back on the sloping side of the heap, and distributed so as to retain the original form of the heap. Thus the heaps slowly changed their position but retained their forms. This method yielded results in about a year – probably in human climate in eight months. ⁴

The Swedish Method

The Swedish method did not differ in any essential respect from those which had already described. First a clay floor was prepared upon this was placed a mixture of earth, mould, spend ashes, animal and vegetable refuse of all kinds. Small twig branches, straw and leaves were added, to make the mass porous; a light covering, to protect from weather, frequent watering with urine or dung-water, and turning over every week or two. The process was precisely the same as the French, except that the process of preparation and nitrification were not separated.

The Swiss Method

The method practiced by the small farmers in Switzerland was very simple. It required little or no care, and was admirably adapted to the hilly portions of the State. A stable with a board floor was built on the slope of a hill (a northern slope was best), with one end resting on the ground, while the other was elevated, several feet, thus allowing the air to circulate freely below. Beneath the stable a pit two or three feet deep, and conforming to the slope of the hill, was dug and filled with porous sand, mixed with ashes or old mortar. The urine of the animals which was absorbed by the porous sand became nitrified, and was fit for leaching in about two years. The exhausted earth was returned to the pit, to undergo the same process again. This leached earth induced nitrification much more rapidly than fresh earth; so that after the first crop the earth might be leached regularly every year. A moderate sized stable yielded with every leaching about one thousand pounds of saltpetre. ⁵

Leaching

When the process of nitrification was complete, the earth of the heaps were leached. Manufacturers were accustomed to judge roughly of the amount of nitre in any earth by the taste. A more accurate method was by leaching a small quantity of the earth, and boiling to dryness, and weighing the salt. There was much diversity of opinion as to the percentage of nitre necessary to render its extraction profitable. The best writers on this subject vary in their estimates from fifteen pounds to sixty pounds of saltpetre cubic yard of nitrified earth. The high price of nitre would make a smaller percentage profitable. This point, however was determined by the enterprising manufacturer.

In the process of leaching in order to save fuel, they wanted to get as strong a solution as possible and at the same time to extract all or nearly all the nitre. These two objects would only be attained by repeated leaching of the same earth. The ley thus obtained were used on fresh earth until the strength of the ley was sufficient. A quality of nitrified earth was

thrown into a vat, or ash-tub, or barrel, or hogshead with an aperture below, closely stopped and covered lightly with straw. Water was added, about half as much in volume as the earth. After stirring, this was allowed to remain twelve hours. Upon opening the bung, about half the water ran through containing, of course, one-half the nitre. Pure water, in quantity half as much as first used was again poured on, and after a few moments run through. This contained one-half of the remaining nitre, and therefore one-fourth of the original quantity. Thus the leys of successive leaching became weaker and weaker, until after the sixth leaching, the earth was considered as sufficiently exhausted. The exhausted earth was thrown back on the nitre-beds, or else mixed with black earth to form new beds. The leys thus obtained were used upon fresh earth until the solution was of sufficient density to bear an egg. It then contained about a pound of salt to a gallon of liquid.

Conversion

The ley thus obtained had possessed, besides nitrate of potash (nitre), also nitrate of lime and magnesia, and chlorides of sodium and potassium. The object of the next process was to convert all other nitrates into nitrate of potash. This was done by adding wood ashes. The potash of the ashes took all nitric acid of the other nitrates forming the nitrate of potash (nitre), and the lime and magnesia were precipitated as an insoluble sediment. Sometimes the ashes was mixed with the nitrified earth and leached together, sometimes the saltpetre ley was filtered through wood ashes, sometimes the ley of ashes was added to the saltpetre ley. In either case the result was precisely the same.

Crystalization

The ley thus converted was then poured off from the precipitate, into copper or iron boilers. It still contained common salt (chloride of sodium) in considerable, and some other impurities in smaller

quantities. It was a peculiarity of nitre that it was much more soluble than common salt in boiling water, but much less soluble in cold water. As the boiling proceeded, and the solution became more concentrated, the common salt was most of it, precipitated in small crystals, as a sandy sediment and might be raked out. Much organic matter rose as scum, and must also be removed. When the concentration had reached almost the point of saturation, the boiler must be allowed to cool. This was known by letting fall a drop of the boiling liquid upon a cold metallic surface. If it was quickly crystallized, it was time to stop the boiling. It was now poured into large receivers and left to cool. As the ley cooled, nearly the whole of the nitre was separated in the form of crystals, which sank to the bottom. These were then removed, drained by throwing them in baskets, and dried by gently beat. The mother-liquor was either thrown back into the boilers, or else used in watering the heaps. The product thus obtained was the crude saltpetre of commerce. It still contained fifteen to twenty five percent of impurities principally common salt (chloride of sodium), chloride of

potassium and organic matter. In this impure form it was usually brought to market.⁶

There was still another process, viz: that of refining, by which the whole of the impurities were removed.

Refining

One hundred gallons of water was poured into a boiler, and crude saltpetre added from time to time, while the liquid was heating, until four thousand pounds were introduced. This would make a saturated solution of nitre. The scum brought up by boiling must be removed, and the undissolved common salt were scraped out. About sixty gallons cold water was now added gradually, so as not to cool the liquid too suddenly. The liquid was then suffered to cool to one hundred and ninety-four degrees, and then carefully ladled out into the crystallizers. These were large shallow vats, with the bottom sloping gently to the middle. In these the cooling was completed with constant stirring. In the process of cooling nearly the

whole of the nitre was deposited in very fine, needle-like crystals, which as the deposit were removed and drained. In this condition it was called saltpetre flour. The saltpetre flour was then washed of all adhering mother-liquor. For this purpose it was thrown into a box with a double bottom. The lower bottom with an aperture was closely plugged, and the false bottom was finely perforated. By means of a watering pot a saturated solution of pure nitre was added, in quantity sufficient to moisten thoroughly the whole mass. After remaining two or three hours to drain, the plug was removed and the solution ran out. This was sometimes repeated for several times. The saturated solution of nitre could not, of course, dissolve any more nitre, but dissolved freely the impurities present in the adhering mother-liquor. Last of all, a small quantity of pure water – only about one pound to fifty-three pounds of the nitre to be washed – was added in the same manner, and run off at the end of two hours. The nitre was now dried by gentle heat and constant stirring, and might be considered quite pure, and fit for the manufacture of gunpowder.⁷

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CHAPTER 3

ENVIRONMENTAL DEPOSIT OF SALTPETRE

Saltpetre was a unique industry which was totally depended on environment in early colonial Bengal Presidency. The entire organization of production was carried on with the help of favourable season, weather and environment. Without the support of congenial climate, soil and environment, collection of raw material, filtration of crude saltpetre and boiling of brine were impossible. Raw materials for manufacturing saltpetre were collected in different seasons and by different methods. Sometimes it was collected in mid-July and mid-September and sometimes in winter season. John Kidd, Professor of Chemistry at Oxford, observed that nitre, an important ingredient of raw material, was abundantly available in clear frosty weather and that in a moist state of atmosphere the formation of nitre either did not take place or went on very slowly. ¹

The saltpetre workers were called as Nunias or Beldars. They collected raw materials by three different methods either by natural process or by artificial means. In each method their main attention was to collect raw materials impregnated with nitre without which making of saltpetre was impossible. In the language of Chemical Science saltpetre can be called potassium nitrate. Natural or spontaneous formation of raw saltpetre with the help of congenial weather and atmosphere was very important. Saline efflorescence which contained nitre, were formed due to suitable environment. Leaving aside the collection of raw saltpetre with the help of environment, the nunias mostly depended on a particular type of soil or earth for raw materials. Geographically Bihar was the ideal place for such type of soil. The Nunias depended on this type of earth which they collected from old as also from existing village sites. Such earth was scraped together in small quantities by the Nunias who extracted from it the crude saltpetre. The nitrates which this earth contained were found from organic waste materials, urine, dung and vegetable debris.² From such village earth the Nunias extracted

a crude saltpetre which was purchased by the refiner who prepared from it the much purer grade for export.

But before proceeding to the description of collection of raw materials a few words are essential about the term 'Salt'. If a Chemist examines the materials of saltpetre earth, he will say that they contain not one salt but several "Salts" of which "Common Salt" is only one. It is interesting to note that the earth impregnated with the materials of saltpetre possesses various types of chemical substances. The most important to us on the present occasion are the following. ³

1. Potassium nitrate or "Indian Saltpetre".
2. Sodium nitrate of "Chili Saltpetre"
3. Calcium nitrate.
4. Sodium Chloride or "Common Salt"
5. Sodium saltpetre or "glauber's salts"

Surprisingly enough, the earth or soil of some parts of Bihar contained such chemical substances for making saltpetre.

Another matter which is important to a correct understanding of the saltpetre industry are the terms 'soluble', 'solubility', 'saturated solution'. The phenomenon of solution was well known to the refiners of saltpetre. If a substance is added to water and is found to disappear in the water, it is said "to dissolve". All the salts above referred to are "soluble" in water but the problem is that the amount will dissolve in water. If the salt called potassium nitrate is added in small portions to 100 parts of good well-water, it will continue to dissolve until a certain amount has been added, when the water will fail to dissolve any more. Well-water in India had commonly a temperature of about 25°C. At this temperature the 100 parts of water would dissolve about 37 parts of the nitrate. This was a "saturated" solution at 32°C. If the water was heated to the temperature 100°C, it would take up no less than 247 parts of the nitrate. This was a "saturated solution" at 100°C.

Apart from this, in the discussion about raw materials of saltpetre an understanding of the climate and soil profile of Bihar is essential because collection of raw materials were mostly depended on soil or

earth and climate or environment. The Bihar plain was divided into two unequal halves by the river Ganga which flows through the middle from West to East.

Climate & Soil Profile of Bihar

According to Francis Hamilton Buchanan the raw materials for production of saltpetre were collected from a specific type of soil.⁴ The soils were of three types – black, yellow and white. However the black soil was mostly favoured. The saltpetre was produced in a soil which contained a large proportion of saline matter, such as nitrate of potash (saltpetre), nitrate of lime, sulphate and nitrate of soda and carbonate. But in general the sulphate or soda was most abundant. The saltpetre lied in patches as it were, some parts being more productive than others where carbonate of lime and sand alternately predominate. By analyzing the different soils, it was found that those places were most productive where nitrate contained a redundancy of the former, and on the contrary, where the soil was unproductive. Therefore it led to the conclusion that carbonate of lime was one of the principal agents in the formation

of this article. The district of Tirhut in Bihar was more productive of nitre than any other places in India. For almost half of its soil was calcareous.⁵

Climate and Soil Profile of Bihar

Bihar is located in the eastern part of India.

Physical Features	
Latitude	24°-20'-10" - 27°-31'-
Longitude	83°-19'-50" - 88°-17'-
Rural Area	92,257.51 sq. kms
Urban Area	1,095.49 sq. kms
Total Area	94,163.00 sq. kms
Height above Sea-Level	173 Feet
Normal Rainfall	1,205 mm
Avg. Number of Rainy Days	52.5 Days in a Year

[Source : Internet]

It is bounded by Nepal in the north, by Uttar Pradesh & Madhya Pradesh in the West, by Jharkhand in the south and West Bengal in the East. The Bihar plain is divided into two unequal halves by the river Ganga which flows through the middle from west to east.

Climate of Bihar

Bihar has continental climate with four distinct seasons. Northern part of the state experiences cooler compared to Southern part due to nearness to the Himalayas; Eastern part experiences humid climate due to nearness to the Himalayas while Western part have dry weather due to continental effects. Hence, the climate of Bihar is also called as 'Modified Monsoon Climate'.

Factors affecting climate of Bihar

1. Location: Its location is tropical to sub-tropical, i.e. 22 degree north to 27 degree latitude.
2. Distance from the Himalaya: It is located on the northern side of the state that makes significant bearing on the distribution of monsoon rainfall.
3. Distance from the Sea: It is an entirely land-locked state, although the outlet to the sea through the port of Kolkata is not far away.

Seasons in Bihar

1. Cold weather season (December to February): It is characterised by low temperature, light northerly winds, clear skies and low humidity.
2. Hot weather season (March to May): Temperature ranges from 29 degree Celsius in the east to 40 degree Celsius in the west. The temperature in the east declines due to Nor'wester shower impact.
3. Southwest monsoon (June to September): The burst of monsoon in Bihar is generally associated with the sudden arrival of intense cyclonic storms with thunder, lightning and torrential rain. It happen due to the low pressure develops over the plain while high pressure develops over the Northern Bay of Bengal Sea.
4. Retreating southwest monsoon (October to November): This monsoon is locally called 'Hathiya Nakshatra' because it gets incessant rain causing floods.

Soil Profile of Bihar

Bihar is situated on the World's fertile alluvial plain of Gangatic Valley which extends from the foothills of the Himalayas in the north to a few miles south of the river Ganges as it flows through the State from the west to the east. Variation in relief, precipitation, vegetation and parents rocks have resulted various soil variety due to the region relief features.

Soils of Northern Plain

Soil of this region is formed due to the deposition sediments brought by Gandak, Burhi Gandak, Mahananda, Kosi and Saryu rivers. Hence, the soil is further divided into three types:

- 1. Piedmont Swamp Soil:** It is swallowing to deep over bed rocks and pebbles. It is mostly clayey, rich in organic matter and neutral reaction. This type of soil is found in North-Western

Chamaparan district.

2. **Terai Soil:** It is grey to yellow in colour and neutral to moderately acidic in reaction. The soil of Terai is more fertile than upland terai. This type of soil is found in the northern part of Bihar near by the border of Nepal and footbill of Himalaya.
3. **Gangetic Alluvium Soil:** This soil is generally fertile in Bihar plain but to regular tillage without application of manure have costs low organic content. It is mostly loamy with varying thickness. It is thinner towards south and thicker towards north.

Soils of Southern Plain

This type of soil is found between North Ganga plain and Southern plateau and it formed due to the alluvium deposited by Sone, Punpun, and Falgu Rivers.

1. **Karail-Kewal Soil:** It is heavy clay soil (alkaline feature) which is characterised by wet paddy lands or dhandhar. It is found in Rohtas to Gaya, Aurangabad, Jahanabad, Munger and

Bhagalpur. It is best suited for rice and rabi crops like wheat, linseed, pulses and gram.

2. **Tal Soil:** It is found in backwater belt of Ganga which is spread from Buxar to Banka district. The colour of the soil varies from light grey to dark grey and in texture from medium to heavy soil. Rabi or spring crops like wheat, khesari, gram, peas, masoor, and lentsil are harvested after water dries up and their yield is quite high.
3. **Balthar Soil:** It is less fertile and has less water absorption capacity. Maize, jowar, bajra, and gram are chief crops. It is found in Kaimur plateau to Rajmahal hills in narrow belt.

Soils of Southern Plateau

There are two types of soil found in southern plateau of Bihar.

1. **Red and Yellow Soil:** These soils are formed from the disintegration of igneous and metamorphosed rocks. They are less fertile and thus suitable for coarse crops and pulses. It is found in Banka, Gaya, Aurangabad, Jamui and Munger.

2. **Red Sandy Soil:** This soil has higher percentage of sand that makes it less fertile and suitable for bajra and jowar crops.

List of Soils in Bihar

Types of	Area	Properties of the soil
Balthar	Kaimur	Sandy, calcareous, yellow
Tal	Patna and Munger	Heavy soil
Terai	Champaran and	Sandy, calcareous, brown and
Bhangar	Patna, Gaya and Rohtas	Acidic and rich in lime
Khadar	Muzaffarpur, Purnia, Saharsa, Dabhanga and Bhagalpur	Dark brown and fertile
Bal Sundari	Saharsa, East and West Champaran	Lime and alkaline

[Source : Internet] Some of the above mentioned geographical features are changeable.

Different Methods of collection of Raw Materials of Crude Saltpetre

First Method :

Impact of Nature and Environment.

In collection of raw material, the first method was totally depended on environmental situation because it was formed by dint of nature. It was naturally produced. Therefore the first method throws some light on a very obscure part of natural history. The nuns collected raw materials from old mud walls of the villagers. During a particular season specially in winter or in month of November, a laire of nitre, essential for saltpetre making, were usually stored on these walls due to ecological factors of a particular geographical area. Some places of Bihar like Purnea and Tirhut were particularly important for collection of raw materials. The environmental situation was

favourable in these places for getting raw materials from the walls. In the month of November, the nunias commenced their operations by scraping the surface from old mud heaps, mud buildings, waste grounds where the saltpetre was developed itself in a thin white efflorescence, resembling forest rind. In Tirhut, Saran, Patna, Gaya, Mungher, Bhagalpore and Purnea saline matter was found in the neighbourhood of old houses and also in old mango groves.⁶ The formation of raw materials in these places depended on dry weather. Dr. Kidd, Professor of Chemistry at Oxford, had observed that after scraping the efflorescence or raw materials it was again reappeared quickly. Therefore, the nunias had to scrap it again and again resulting in collection of a large amount of raw materials. Kidd was of opinion that the occurrence of saltpetre on walls of old buildings with putrescent animal and vegetable matter, from a mixture of which kind, after exposure for a sufficient length of time to the action of the air, a quantity of nitre might usually be obtained by lixiviation.⁷ He found that a definite connection was existed between the natural production of nitre and the state of the atmosphere. He found that the

presence of lime was necessary to the natural production of saltpetre. He also found the presence of common nitre in the efflorescence. He said that the reproduction of the nitre was connected with some changes in the state of the atmosphere. He was of opinion that the formation and reappearance of saltpetre took place in frosty weather. The spontaneous formation of saltpetre was generally speaking, much more extensive and rapid in winter than in summer.

When the spontaneous formation of nitre took place slowly and in a sheltered situation, it was at first visible in the form of minute prismatic crystals which were usually projected from the surface of the wall, but sometimes they were scattered in different directions. In general, however, the saline efflorescence made its appearance in extremely minute capillary crystals, accumulated in groups resembled with the fallen flakes of snow. The spontaneous formation of nitre took place indifferently on the surface of the mud wall. After a careful removal of efflorescence, its reproduction took place to the same proportional extent in the same parts. A frosty,

clear and dry state of the atmosphere was particularly favourable to the natural production of nitre. The free presence of atmospherical air was absolutely necessary in the spontaneous production of nitre. The saltpetre formed in the situation described above consisted of full 99 parts in 100 of nitrate of potash, with very minute proportion of some calcareous salt.

Regarding first method it can be concluded that the efflorescence took place only where the exterior of the wall on which it was formed, was either exposed to the direct influence of the weather, or was in contact with the adjacent ground. The effect of atmosphere depended upon the action of the external air, or of the moisture of the ground transmitted through the substance of the wall. It was evident that the natural production of the saltpetre was closely connected with the changes in the state of the atmosphere. Those changes were related not only to its temperature but also to the degree of its moisture and barometrical pressure. In case of comparing the elements present in the composition of the saltpetre formed, with the elements of the substances present during its formation, it can be reasonably concluded

that the potassium or the metallic base of the potash of the saltpetre, was either a simple principal of some of the elements present, or that it resulted from the union of two or more of those principals, or of two or more of the elements themselves. ⁸ The gross compounds present during the formation of saltpetre were atmospherical air and the limestone on which the saltpetre effloresced and all the component parts of those might be ultimately resolved into the following elements – oxygen, nitrogen, hydrogen, and carbon, together with iron and the metallic basic of some of the earths. The component parts of nitrate of potash of which the saltpetre was entirely consisted were – nitric acid, water and potash which might be resolved into the following elements – oxygen, nitrogen, hydrogen and potassium. All these elements were known to be present in the situations where saltpetre was formed, with the exception of potassium. ⁹ It is generally supposed that the saltpetre was a product and not an educt of the above process since no potash could be detected in the air, the potassium must be contained in a free state in the atmosphere. But Prof. Kidd was of opinion that saltpetre might be considered as an educt of the process and that it might possibly

be existed already formed in the atmosphere in a state of minute division. ¹⁰

Second Method : Impact of Cow's urine

The second method was very interesting in the collection of raw materials. According to Francis Hamilton Buchanan, the raw materials for production of saltpetre were also collected from specific type of soil impregnated with cow's urine. ¹¹ The soil were of three types – black, yellow and white. However the black soil was mostly favoured. The nunias or producers of saltpetre had to take much trouble to collect raw materials. The major problem was to make the situation favourable for the availability of cow's urine. To assemble a large number of cows on a particular type of soil was very much problemetical. Mr. Buchanan has given an interesting account of the difficulties faced by the nunias in time of collection of cow's urine.

In the districts of Purnea, Bhagalpur and Monghyr nitre was never found in the soil at a distance from residential houses ¹² The natives considered it as entirely the produce of cow's urine and during the where season, where the soil was favourable and wherever cows were kept, it effloresced on the surface. ¹³ The only thing required was a clay soil, which prevented the animal matter from being suddenly absorbed ¹⁴ the Beldars, therefore, worked in the farm yards and scraped the surface of the ground wherever the cattle stood and this was repeated every third or fourth day. ¹⁵ The people who had cattles were either pure Hindus or Muslims and they had an aversion to allow this operation, as they either abominate The Beldars, as impure or were jealous of their coming near the women. ¹⁶ The Beldars therefore, faced considerable difficulty in procuring a sufficient quality of raw materials for their livelihood. ¹⁷ They had therefore recourse to another method.

Third Method : Impact of Earth or Soil

The Numias also collected raw materials from the earth or soil by building up farm yards. Between the middle of July and the middle of September, they repeatedly ploughed a plot of ground, and threw on its surface all earth, from which saline matter had been separated by filtration.¹⁸ This earth was called "Sithi". They then daily collected as many cattle upon the plot as they could and kept them there as long as possible¹⁹ About the end of October the nitre began to effloresce and the surface of the plot might be scraped once in four days, so long as the fair weather continued.²⁰ The earth scraped from the field gave less nitre than the procured from farm yards, but the nitre of the latter contained more impurities. In order to avoid it, the method of procuring the saline earth by ploughing a field seemed to be preferable.

The quality of ground and expense was considerable, because from one to two acres were quite insufficient to supply a kuthi. However, the lands for the purpose were belonged to the Company. The main difficulty was to procure cattles. But the whole

people of the village allowed their cattles to stand on the plots for half an hours in the morning and evening, rather than submit to the intrusion of the Beldars. Thus a long established custom had been made legal.

The earth from which the crude saltpetre was obtained, contained very varying amounts of nitrate. Based on the analyses of a large number of samples of earth Mr. Hooper estimated that in these earth the nitrate varied from as little as 1-0 percent, upto as much as 29 percent ; but the general quality of these earth did not contain much more than 3 to 5 percent.²¹ In addition to these nitrate, the earth always contained several percent of chloride and sulphate.²² The process employed by the Nunias in the extraction of nitrate was as efficient as it was interesting. If the earth were mixed with water, the quantity of water utilised would certainly approximate to that of the earth, and hence the obtained solution would contain only some 5 percent or so if nitrate was frequently less. Moreover, the earth could not be efficiently separated from the solution without much more costly appliances than the Nauias could afford.²³

The following is a brief description of the Nunia's method of extraction of raw materials from earth. The Nunias built up an earthen chamber called "Koria" or "Kothi" with wet mud which was allowed to dry. This Chamber had either circular walls some 5 or 6 ft. diameter or oblong walls and a floor which sloped somewhat from back to front. In the front wall there was a hole at the level of the bed which allowed the nitre liquor to drain away (See Plates I and II) Above bottom of this earthen chamber was laid, resting on a few loose bricks, a "false bottom" of bamboos and matting occasionally some grass were used, but that did not lead to efficiency and was probably utilised to fill holes in damaged matting. ²⁴

On this matting the saltpetre earth was laid and water was poured over it. However, the efficiency of the process depended on the mode of filling the earth into the "Koria". If it were imperfectly put in, the water would create cracks or fissures and the muddy water would run away below. Therefore, the earth was filled in with the greatest care. It was slightly moist and was freed as far as possible from stones or fragments of bricks or pottery. First a portion, i.e. one fourth part of

the earth, was spread carefully over the matting, then the Nunias treaded it most carefully all over (See Plate II). More earth was spread over the first portion, followed by careful treading. The process continued until a layer of some 6 or 8 had been introduced. Generally some of the wood ashes from the fire place were mixed with them before filling. It is significant to mention that these earths often contained calcium and magnesium nitrate as well as potassium nitrate. The wood ashes contained potassium carbonate which would change any calcium or magnesium nitrate into the potassium nitrate. Now water was poured over the surface and in order to avoid disturbing the earth, a small piece of matting was placed temporarily on the latter. The addition of water was continued until about 1 inch lay on the surface of the earth. The first added water soaked in very quickly, but the absorption soon became slower and subsequent additions were made at intervals. ²⁵

The water was soaked downwards through the earth and finally after the gap of several hours reached the matting from which it flowed to the bottom of the "Koria" and out at the hole in the side. As it

soaked through the earth, the soluble salts, the nitrates, chlorides sulphates were dissolved in it and were carried downwards. The water which drained downwards first took up the major portion of the nitrate and chloride as it went along and consequently the water which first reached the under surface of the earth contained a much higher proportion of nitrate than would have been the case if the earth had been “mixed” with the water. The first “liquor” to run away from the Koria was often quite a concentrated solution of salts. It was usually clear for since it percolated very slowly the earth was not disturbed. Its colour was brown because in addition to the salts, it also dissolved brown organic matters. Thus whereas any macerating or mixed process would produce a very weak solution, the percolating process produced a strong one ²⁶ The former would require many times as much fuel to boil down the extract as it actually required for the strong solutions obtained.

In this way the first liquor drained away from the Kuria. This portion was put into the pan by the Nunias. As the water continued to percolate through the earth, there was less and less nitrate for it to pick up and

consequently the liquor running away become weaker. If the process was continued by addition of water at the surface all the nitrate and other salts in the earth were dissolved and passed out of the Kuria. In this case, the Nunias had to boil down strong solutions which was difficult for them to afford the fuel required to boil down the weaker ones. For this reason they poured sufficient water on the surface of the earth in the Kuria to yield strong liquors.²⁷

When the process was closed, the Nunias possessed three things – First, some strong liquor which could afford to boil down. Second, some weaker liquor and the Third, the wet earth in the Kuria. The first often contained a large part of the nitrate which was in the earth when packed into the Kuria. The second and third contained some material portions. In order to avoid losing this nitrate, the weaker liquor was thrown on to the earth of the factory and the wet earth was dug out of the Kuria and allowed to dry gradually . However, all this earth about the factory was broken up, air-dried and again put into the Kuria for extraction. In fact, this process was a never ending one. The whole of the earth in the

factory consisted of earth which had been already partly extracted and on which small amounts of weak liquors were thrown.²⁸

Now one question arises. Was it the case that nitrification was constantly going on in these factory earths ? If it were not so, the earths must become weaker in nitrate in each time of extraction in the Kuria. It was time that the Nunias always brought into their 'factory' some fresh village earth, which was commonly of frequently mixed with old earth when packed into the Kuria. This method accounted for some additions of nitrate. In fact in every factory there was a constant additions of earth and a constant abstraction of nitrate. Probably unless the whole earths were aided in some way by nitrification at the factory, it would become weaker and weaker as time went on. Actually nitrification implied the change of organic nitrogenous compounds into nitrites and nitrates. But the Nunias made no special additions of organic materials. It is true that assimilation of atmospheric nitrogen went on coupled with nitrification, but this process was so limited in intensity that external addition of nitre earth was also

necessary. The fact is that the saltpetre industry was depended on the nitrification of organic compounds.²⁹ The composition of crude saltpetre actually varied a good deal and this is illustrated by the following analyses.³⁰

		Muzaffarpur		Burhanpore
		Percentage		Percentage
Potassium Nitrate	-	49.26	-	68.10
Calcium Nitrate	-	3.28	-	2.69
Magnesium Nitrate	-	7.44	-	2.12
Sodium Chloride	-	16.82	-	17.98
Sodium Sulphate	-	14.60	-	3.40
Insoluble matter	-	1.50	-	1.70
Water	-	7.00	-	3.80
		100.00		100.00

Source : Agricultural Ledger, Vol. XII, P.31 quoted in the article 'The Indian Saltpetre Industry' by Leather and Mukherji, Calcutta, 1911.

Another Process of Collection of Raw Materials

The Nunias also procured nitre by utilizing another process.³¹ After boiling the brine twice, and taken from it the saline matter that subsided, there remained a thick brine which was called Jarathi.³² The Beldars separated some of the earth procured in filtering the brine, and poured the Jarathi on it. After two days exposure to the air, it was again lixiviated, and produced a brine containing saltpetre. The Jarathi was chiefly utilised to obtain an impure culinary salt which the natives used. The manufacturers usually mixed the Jarathi with the earth left by lixiviation (Sithi).³³ The saline earth procured by mixing the evaporated brine (Jarathi) with the Sithi was called Bechuya. But before filtering through it, it was usually mixed with the Cheluya or earth procured from the farmyard or cultivated plot. However both yielded saltpetre separately.³⁴

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CHAPTER : 4

TECHNOLOGY IN MAKING SALTPETRE

After collection of raw materials the next important task of the manufactures was filtration and boiling which ultimately produced crystallized saltpetre. But the technology followed in performing this crucial task was very much indigenous. Although rude, the technology was very simple and more effective than most of the scientific chemists performed. No manufacturer in Europe equaled it in point of cheapness and simplicity. When it is considered that these simple people had no knowledge whatever of Chemistry as a science, it is suprising how well they managed to make this article. The process of filtration and boiling has been described by J. Stevenson, Superintendent of Saltpetre Factories of Bihar, Francis Buchanan, and Dr. J.W. Leather and Jatindra Nath Mukherji two

famous Chemists of Pusa Agricultural Research Institute.

The whole operation of filtering and boiling was performed in the open air, by which occasional losses were suffered, especially in spring, when there were often heavy showers that intailed the season. A shed, 25 cubits long and by 16 wide, would enable a family to reserve as much saline earth as would give them employment to boil the whole year. ¹ The chief advantage of the shed was that it enabled the manufacturers to turn the Jarathi or lay remaining after evaporation, to better advantage. If mixed with the earth called sithi, exposed for some days to the air, and then collected in leaps for some weeks, the produce of nitre was great. Some rich men had sheds for this purpose. ² The apparatus was very simple. A circular vessel, called a 'Kuthi' was formed of unbaked clay on the surface of the ground.³

Process of Filtration and Boiling : Stevenson's Description

Filtration was done by a large mud filter, lined on the side with stiff clay. It was a round hollow basin is shape resembling the top of a well from 6 to 8 inches in diameter. A false bottom was formed of pieces of brick .⁴ This left an empty space of a few inches above the soil bottom, for an outlet to the filtered liquor. Over these bomboos a covering of strong close wrought grassmats were laid, which completed this simple form of filter. The operation then proceeded with the process, by spreading over the mats a thin layer of vegetable ashes, generally from the indigo plants, upon which the earth was to be subjected to the filtering process. It was laid and trodden to down level and to the desired solidity, as the operators felt. This required great attention on the part of the man who performed it ; for as it was too soft, the water would pass through quickly for the solution of the saline matter to take place. Otherwise the full products would not be obtained. After this point has been adjusted, water was poured gently

upon the earth to the depth of 4 or 5 inches, according to the size of the filter and quantity of earth used, (one of six feet diameter would filter 20 maunds of earth)⁵ The whole was then suffered to remain tranquil for several hours, during which time the water gradually passed through the earth dissolving the saline matter in its passage and filtering through the mats, drops into the empty space between the soil and false bottoms and was conveyed by means of a spout of bamboo, or a hollow to be filled into an earthen receiver, which was made large enough to hold the full quantity of filtered liquor. The brine procured by filtering water through the earth was called 'Ras'.⁶ The saltpetre liquor, thus obtained was more or less coloured with oxide of iron and decomposed vegetable matter. Its specific gravity also varied with the quality of the earth operated upon. An average from a great number of filteres were 1.120.⁷

Boiling :

The second process was to evaporate the saltpetre liquor to a crystallizing state, which was effected in earthen pots fixed in two rows over an

oblong cavity dug in the ground, the interstices between the pots filled up with clay. An aperture at one end of the cavity served for an egress to the smoke; another at the opposite end was used for the introduction of fuel, which was generally dry fallen leaves gathered from the amtopes (mango groves). Such were the simple materials used in this part of the manufacture. The boiling continued till the liquor was evaporated to the crystallizing point, which was ascertained by the operator taking from time to time a small portion of the liquor from the pots and setting it aside to cool in small earthen dishes, like a common saucer. After the liquor had been cooled and the crystals formed agreeable to the practice of the operator, the fire was stayed and the liquor removed to large shallow earthen dishes (which were used instead of crystallizing coolers) placed in rows and sunk to the brine in soft earth. At the end of about 30 hours, the process of crystallization was finished. The crystals of saltpetre were taken out of the coolers and put into baskets to drain, after which they were removed from the store house for sale.⁸

During the operation of boiling it occasionally happened that too much heat had been used, and the pots were in danger of boiling over. To prevent this, the operator had a very simple remedy, which the scientific operators might not be ashamed to take a lesson from - a bunch of dry jungle grass was fixed at a right angle, to the end of a stick. This was dipped into the liquor, and held up over the pot and the liquor which it had absorbed, and fell down in a shower (cooled by the air) into the vessel. ⁹ The temperature being thus reduced, the evaporation proceeded more steadily, and the accidental boiling over was prevented. The mother liquor, remaining after the crystals of saltpetre had been removed, and returned to the evaporating pots and mixed with a fresh portion of the liquor from the filters, for a 2nd boiling and crystallization. The extraneous salts, such as sulphate and muriate of soda, which the filtered liquor from the earth always contained, were partly found at the bottom of the pots (the muriate of soda in particular) and partly in the mother liquor, remaining after the process of crystallization. But to separate them more effectually, the manufacturer passed the liquor from the boilers through a piece of coarse cloth, placed in a

basket, and when the liquor had drained through, the greater part of the extraneous salts were found on the cloth. To do this effectually, it was necessary, that the liquor should be at the boiling point, otherwise the saltpetre liquor would not leave the sulphates and muriates, but would form an anhydrous mass.

The muriate of soda or common salt, was rendered more pure by a subsequent boiling. It was then called by the natives pakwa nimak, and was sold in the bazaars as an article for culinary purpose. The remaining extraneous salt - sulphate of soda, nitrate of lime and carbonate, were returned to the earth, to undergo a change by decomposition for another season. The nitrate of lime was decomposed by the carbonate of potash which the vegetable ashes, used in the process contained. When solutions of these salts came in contact with each other, a mutual decomposition took place. The nitric acid of the lime was combined with the potash and the carbonic acid of the potash was combined with the lime.¹⁰ In this manner, the old earth, which had already produced saltpetre was regenerated, and rendered productive for other season. Owing to the porous nature of the

earthen crystallizing vessels, a part of the saltpetre liquor oozes through the bottom, and was absorbed by the earth, on which the utensils were placed. Occasionally, they were broken and the contents of course fell into the earth below. This earth was again subjected to the process of alteration.¹¹

Thus the nunias proceeded from season to season, without the least deviation or alteration in their manufacture. No persuasion; whatever reasonable, by way of improvement, would cause them to alter the plans, which their forefathers had in practice. Perhaps the methods used by the nunias were the same as were followed in the past.

System of Filtration and Boiling : Buchanan's Description :

Buchanan had also described in detail about another system of filtration and boiling before making saltpetre.¹² He said that the Beldars had another process by which they could procure nitre. After boiling the brine twice and taken from it the saline

matter that subsided, there remained a thick brine which they called 'Jarathi'. The Beldars spreaded out some of the earth procured in filtering the brine, and on this poured the Jarathi.

After two days exposure to the air this might again lixiviated and produced a brine containing saltpetre. The Jarathi was chiefly used to obtain an impure culinary salt, which the local people called 'Beldari Nemak'. Its use was prohibited, but it was smuggled, and mixed with the poured salt. The fact is that Beldars usually mixed the Jarathi with the earth left by lixiviation (Sithi). The saline earth procured by mixing the evaporated brine (Jarathi) with the Sithi was called 'Bechuya' and before water was filtered through it, Bechuya was usually mixed with the Cheluya, or earth procured from the farmyard or cultivated plot. Both of it separately gave saltpetre.¹³

The whole operation of filtering and boiling was performed in the open air which had to face possibility of heavy shower. To solve this problem a shed was built up which contained 25 cubits long by 16 wide. It enabled a family to reserve as much saline earth as

would give them employment to boil the whole year. The chief advantage of the shed was that it enabled them to turn the Jarathi after evaporation for better advantage. The mixed earth called Sithi was exposed for some days to the air, and was then collected in heaps for some weeks or months. By this process the production of nitre was great. Some richmen had sheds for this purpose.

The apparatus, as usual was very simple. A circular vessel called a Kuthi, about three feet in diameter and one foot deep was formed of unbaked clay on the surface of the ground.¹⁴

A small hole in the bottom at one side allowed the water poured into the vessel to flow into a pot, which was placed in a hole formed by the side of the vessel. A little straw had been put on the bottom of the Kuthi and was filled with a saline earth, which was well trodden with the feet, and a quantity of water was filtered through it, which was sufficient to produce a strong brine. The people were neither very careful to extract the whole saline matter, nor by repeated filtrations to saturate the water. The last one was a

gross negligence in the economy of the operation. The former was of little consequence, as the same earth was always re-used, and the saline matter, which was allowed to retain, became soon impregnated.

However, some Beldras always mixed the ashes of straw with the saline earth, in the proportion of one-twentieth part. They however confessed that they usually put a small quantity of ashes. It made the brine flow more readily during filtration. They also added some ashes when the saline earth was very dry. It was very doubtful whether there was lime in the soil, and certainly none was ever added. In India, therefore, lime would not seem to be necessary to the generation of nitre, as was the case in Europe.

The Brine procured by filtering water through the earth was called 'Ras'. This was evaporated in earthen pots of hemispherical form. Six for each Kuthi were supported contiguous to each other in two rows over a cavity in the earth that served as a fire-place, and the fuel, chiefly stubble, was thrust under by a small slope at one end, while the smoke went out by

an opening that was formed in opposite side. While the brine had been boiling, a woman, who attended the fire, stired the pots occasionally with a small broom, fixed at right angles to a stick. This removed the article called Khari, which like the Jarathi was mixed with the earth called Sithi. According to the native agent it greatly increased the quantity of nitre. But according to the Beldars it might be made into a kind of salt, called Khari Nematik, which was prohibited. Perhaps this prohibition had arisen from an idea of the Khari and Beldari salts being the same.¹⁵

However when the evaporation had been carried to a certain length, the brine was taken out and allowed to cool. Then the nitre subsided, having a brine which was again put into the boilers and treated in the same manner. When the evaporation was complete, this brine was again cooled, and it deposited more saltpetre, which was called 'Kahi'. The remaining was again evaporated, and deposited a third kind of nitre called 'Tehela'.¹⁶ But all these kinds were sold by intermixing. The residue that remained after the third boiling was the Jarathi.

From Impure to Crystal Saltpetre: A Chemical Analysis.

The saltpetre obtained in the above manner, was a very impure article termed by the natives as 'dhoah', and was sold at the rate from two to three rupees a maund. It generally contained from 45% to 75% of pure nitre. The following analysis was tried from an average of several hundred maunds of what was stated to be good quality and was bought at 3 rupees 8 annas per maund.

100 grains operated upon.

Insoluble matter, sand and mud	5.0
Sulphate of Soda	9.1
Muriate of do	<u>8.0</u>
Total impurity	22.1
Nitre	<u>77.9</u>
	100.0

[Source : J. Stevenson, 'On the Manufacture of Saltpetre', Journal of the Asiatic Society,' Vol. 2, 1833]

This may be taken as a fair sample of the quality that the nunias produce in general. But when it passed from their hand to the saltpetre marchents, it was frequently adulterated with sand, mud and dirty salts of various kinds, to such a degree, that it scarcely contained 50% of pure nitre. A sample of these adulterated article from 15,000 maunds gave the fallowing result:

Insoluble matter, sand & mud	22.7
Sulphate of Soda	23.8
Muriate of do	4.2
Total impurity	50.7
Nitra	49.3
	100.0

(Source : J. Stevenson, 'On the Manufacture of Saltpetre' Journal of the Asiatic Society,' Vol. 2, 1833)

To produce the article called by the natives Kalmee (Crystallized in long prisms, meaning the best kind of saltpetre) the dhoah was re-dissolved and crystallized; the percentage of nitre would then amounted from 85 to 95 pure. But this was only done by the opulent native marchants who supplied it to the

Calcutta bazar.¹⁵

In conclusion, it can be said according to Stevenson that the above methods of manufacturing saltpetre used by the indigenous people of Bihar although rude, yet were very simple and more effective than the methods used by the European scientific chemists. No manufacture in Europe could equal it in point of cheapness and simplicity; and when it was considered, that these simple people had no knowledge whatever of chemistry as a science, it is surprising how well they managed to make the rough article like saltpetre.

Fiteration, Boiling and Crytallisation : Description with a Chemical Analysis :

Dr. J.W. Leather and Jatindra Nath Mukherji, two well known chemists of Pusa Agricultural Research Institute, had also decribed the process of production of refined saltpetre.¹⁷ According to them the crude saltpetre was added to a boiling hot “mother” liquor from a previous operation. Such a liquor was

saturated with common salt and sodium sulphate, but was able to dissolve large amount of potassium nitrate and lesser quantities of potassium chloride which latter salt was nevertheless frequently present. Consequently when the crude saltpetre was added to the hot mother liquor, the potassium nitrate and other nitrates which might be present, and a small amount of potassium chloride were dissolved, but the sodium chloride and sulphate and the dirt remained undissolved. When the fire was removed, the insoluble matters quickly subsided. The hot clear liquid was run into wooden vats where it was allowed to cool. The insoluble substances remaining in the pan were called "sitta" and were dealt with separately. After the liquor in the vats had cooled, the crystallised potassium nitrate or refined saltpetre were taken out and often washed slightly with water and those were ready for the market. The mother liquor was then used again for dissolving the nitrate from a second lot of crude saltpetre.

It was a rough sketch of the process. But giving in detail, it was found that the mother liquor cannot be utilised over and over again, but only a limited

number of time. Common salt was thrown out at one stage when evaporating mother liquors and the “sitta” which contained much nitrate had to be dealt with.

According to these chemists every refinery possessed a large amount of nitre earth which originated with sitta i.e. portion of the crude saltpetre. It consisted very largely of salts, sodium, sulphate and chloride and potassium nitrate and also common earth.¹⁸ It had been generally assumed that saltpetre grew from this earth. This earth was a necessary adjunct to every refinery. From this nitre earth, the nitrate was extracted by the Nunias. It was packed with great care in the “Kurias”. Usually some wood ashes were mixed with this earth. Cold water was percolated through it and a part of its nitrate was extracted as a strong liquor which was later boiled down. In addition there was some weak liquor produced and there was also wet earth to be dug out of the Kuria again, containing likewise some of the nitrate. The Kurias in refineries were better made than those of the Nunia and they were somewhat larger and were similar.

The following analysis illustrates the composition of the strong liquor first running away from the Kurias.

	<u>Percent</u>
Potassium Nitrate	- 15.21 %
Potassium Chloride	- 3.09 %
Sodium Chloride	- 15.16
Calcium Chloride	-
Magnesium Chloride	- 1.61
Calcium sulphate	- .88
Magnesium sulphate	- .17

[Source: Article by Dr. J.W. Leather & J.N. Mukerji, published by Agricultural Research Institute, Pusa 1911, P.9]

The first strong liquor from the refinery Kuria was dealt with in two different ways. In one of these it was boiled in iron pans and as the water had been evaporated the common salt came out. This salt was taken out and the hot and strong solution containing the nitrate allowed to cool in wooden vats or earthen jars, when potassium nitrate crystals came out. This refined saltpetre was called “Kuthia Sora” But it was apparently not very pure according to the following analysis.

	Burhanpur Percent	Savan Percent
Potassium nitrate	65.21	50.95
Sodium Nitrate	7.74	-----
Potassium Sulphate	-----	1.68
Sodium Sulphate	.61	-----
Potassium Chloride	-----	19.81
Sodium Chloride	220.2	20.95

[Source : Same as before, P.10]

In other refineries, the strong liquor from the 'Kurias' and 'Kothis' was put into a pan containing some 10ft diameter. It was heated with the 'sitta' of a previous operation. The hot liquor dissolved from the sitta the nitrate it contained and also some common salt etc. The clear hot liquid was separated from the mud and the latter then passed to the heap of refinery earth. The mud always carried some liquor with it and hence some nitrate. ¹⁹

The cleared liquid was boiled down. [See plates III and IV] This hot liquid was far from being saturated with nitrate. In fact, $\frac{3}{4}$ ths or more of the water was

evaporated before any saltpetre would crystallize out at the boiling temperature. With respect to the sodium chloride the case was different because it was nearly or quite saturated with this salt and consequently as the water was boiled off, the common salt precipitated. Some mother liquor from the crystallizing vats was added the hot liquor obtained now. Crude saltpetre was added to this mixture which at the high temperature was able to dissolve large amount of nitrate. The mixture was boiled for a few minutes and then the fire was removed from below the pan. The insoluble matters consisting mostly of common salt and earth were allowed to settle and the clear brown and hot liquid was run into the wooden vats. These vats were generally rectangular. The measurement was 7ft x 5ft or 6 ft and about 2 ft. deep. Sometimes these were also small wooden tabs as in [Plate V]. As the liquid cooled in these vats, the dissolved salts were crystallized. Chief among these was of course the potassium nitrate. But sodium chloride and potassium chloride were crystallized. It is important to mention that the refiners allowed the liquid to crystallize very slowly. They had no appliance for separating the crystals from the mother liquor.

Therefore, they drained the liquor away. The refiners produced small and large crystals. In order to produce large crystals, it was essential to cool down the hot liquor very slowly. For this purpose the refinery frequently embedded the wooden vats in earth.²⁰

The refiners sometimes used another device which was very interesting. If the hot liquor were exposed to the air, evaporation which always took place, was considerable. If the water were allowed to evaporate, its sodium chloride separated and increased the contamination with the saltpetre. In order to prevent evaporation from the surface of the cooling liquor, the refiners poured some cold water carefully on the surface of the hot concentrated liquor in the vat. This water was lighter than the nitrate liquor and therefore floated on the surface and the evaporation which took place was provided for by this added water. This water was mixed with the nitrate liquor. Whether water was added in this manner or not, the top liquid soon formed protection to that below because it first cooled, deposited its nitrate and was then higher than the warmer liquid underneath. The upper layer then formed a non-conducting shield

to the lower liquid. ²¹

Process of Crystallisation

The crystallization process proceeded generally for some 8 or 10 days before it had cooled to about 35°C or so when the refined saltpetre was separated. This refined saltpetre was called “Kalni Sora”. Generally its colour was light brown. It was fairly pure as the following analyses exemplify :-

	I	II	III	IV
	Percent	Percent	Percent	Percent
Potassium Nitrate	82.61	96.17	91.19	92.08
Potassium Chloride	11.01	-	3.51	1.87
Sodium Sulphate	-	.15	-	.61
Sodium Chloride	3.61	.86	.61	3.38

[Source : Leather & Mukerji, “The Indian Saltpetre Industry” published by Pusa Agricultural

Research Institute, 1911, P 12]

Washing Saltpetre : The “Dholai” Process

In some refineries the ‘Kalmi’ saltpetre was subjected to a further purification by washing. ²² For this purpose it was placed in sack which was set over a tank [See plates VI and VII]. The mouth of the sack was opened and weak liquor from the tank was poured over it. This weak liquor probably served two purposes – (1) it washed the saltpetre partly and (2) it also wet the whole sack full crystals thoroughly. This preliminary treatment was continued for an hour or more.

Thereafter a small quantity of cold water of about one gallon was poured at exterously over the saltpetre at the top of the sack and was allowed to drain. Naturally this process dissolved some of the nitrate as well as some of the sodium chloride, the removal of which was the principal object of the

washing. However, the result was the production of a purer saltpetre.

It would not be irrelevant here to mention the mode of refining gunpowder in Allahabad.²³ This mode was something different from the mode practiced in the Bengal Presidency which was under the British monopoly system. Not only that the cost of production was higher in the Bengal Presidency than it was in Allahabad. In Allahabad, the cost of production of saltpetre was Rs. 3/- per maund, whereas in Bengal Presidency it was Rs. 4 to Rs. 4 and 12 annas per maund. There was other problem also. In the Bengal Presidency there was additional loss of 3% to 4% in the process of drying gunpowder in the grinding house. There was also wastage of 5% to 8% wastage in the different stages of the manufacture.

The process of refining saltpetre in the Powder Works of Allahabad was divided into various stages. The refiners ought to be more careful to follow the required stages. At first the rough saltpetre was put into the tubs with 20% of its weight of cold water. It

was left to digest for 12 hours in which time the water was drawn off. Then 10% additional fresh water was added which in 4 hours was likewise drawn off and in the third time the quantity of 5% fresh water was poured into the saltpetre which was drawn off in one hour. After this operation, about 80 mds of saltpetre was put into the boiler with 50 mds of water of which when boiling a solution of vegetable Alkali was added to precipitate the foreign salts. When sufficiently boiled, the solution was ladelled into large tubs where it separated all earthy matters and then drawn off into the copper pans to crytalise. The crystals were reboiled in the same manner for a second or a third and sometimes even a fourth time before the saltpetre appeared to be pure enough for the manufacture.

From the water of the boiling pans more saltpetre was extracted by evaporation and purified to the proper degree by repeated boiling as above mentioned till the whole of the saltpetre was extracted and the residue remained excluding earth and foreign salt. The loss in purifying the saltpetre was about 30% but it is far from being of the best kind containing an

unexpected quantity of common salt.

The quantity of firewood used in purifying 100mds of saltpetre of this kind including the repeated boiling and evaporating of the water of the cooling pans was above 200 mds as the firewood was used in the sulphur refinery. ²⁴

Company's Attempt to Improve the mode of Manufacture :

For improvement of the manufacture of Saltpetre the Company made various experiments with the help of chemists. The chief experiment was on the boiling or refining the crude saltpetre. The Board employed I. Fleming and Captain Golding for this purpose. For two sets of experiments the Board also employed Mr. Farquhar. The main purpose of the experiment was to minimise the costing of labour and at the sometime improvement of the quality of the gunpowder. Another purpose of the experiment was to overcome the probable loss of saltpetre in time of refining. During the experiments boiling or the mode

of refining was contamination of nitrous solution of silver with Marine and magnesium salts. From the first boiling the British chemists procured 10 pounds of saltpetre which ultimately would be 8 pounds 11 ounces of crystals. Again when it was redissolved and evaporated to dryness it would be 7 pounds 13 ounces of refined nitre in powder. ²⁶ It would be sufficiently pure for the composition of gunpowder. Apart from this there was another experiment. From the liquor which remained after first crystallization the chemists procured on a second boiling 15 ounces of crystals which being redissolved and evaporated to dryness produced 12 ½ ounces of nitre in powder.

Although in 1790's and in the beginning of 19th Century the Anglo-French relation was very hostile, still for better production of saltpetre the Company did not hesitate to take the help of the French Chemists indirectly. An article was published in vol. 20 of the Journal "Annales de Chemic" written by the Head of the Government Powder Manufactory in France. In this article a new mode of refining saltpetre was highlighted. The Company's Military Board took the help of this article for improving the process of refining

with the ultimate purpose of getting superior quality of gunpowder.²⁷ The experiment centered on the saltpetre produced in Kanpur and Patna. The purpose was to assess the comparative loss of amount of saltpetre in both places. Not only that another purpose was to judge the quality of gunpowder between Kanpur and Patna. Another enquiry of the Company's Military Board was to know which was more effective in final production of gunpowder i.e. crystal or powder. The Chemists finally concluded that powder was more effective than crystalised gunpowder.

By-Products of the Refinery

It is very interesting to mention the by products of the saltpetre refineries. Dr. Leather and Mr. Muherji had discussed about three by-products. On the other hand, Henry Peddington had also discussed and analysed in detail about two by products.²⁸

First By product : ‘Sitta’

According to Dr. Leather and Mr. Mukherji the first by product of the saltpetre refineries was ‘Sitta’. They had described the substances of sitta. The following analyses illustrate its composition :

Patna

Potassium nitrate	-	8.20
Potassium sulphate	-	21.10
Potassicm Chloride	-	-
Sodium Sulphate	-	5.14
Sodium Chloride	-	44.32
Water	-	6.31
Organic matter	-	.70
Sand	-	13.16

[Source : Same as before]

It had been explained that this ‘sitta’ was either mixed with the refinery earth or treated with liquors from the ‘Kuthia’ when much of the earth in it were dissolved.

Second By Product : Common Salt

Common salt was a second by product of the refinery. This like the 'sitta' was not a voluntary product. As a matter of fact the refiners could not separate the sodium chloride. At the time of washing the crystals it was rapidly washed with cold water. Leather and Mukherji estimated that about one-third of the salt was thus redissolved. The real reason for washing and purifying the common salt of the refinery was to get the nitrate away from it rather than to produce good salt.

Third By Product : Waste Liquor

The third by product of the refinery was the waste liquor.²⁹ There were waste liquors from the "Koria" and waste mother liquors. The waste liquors were so diluted that the refiners threw them on to the refinery earths and let them dried up in the sun. The mother liquors from the crystallizing vats were used once or twice over again for dissolving crude saltpetre. But thereafter they were considered as too

impure and were likewise thrown on to the refinery earth.

Thus in the refinery there were constant additions of waste products. They all contained considerable amount of nitrate in the heap of refinery earth.

Piddington's Explanation : Two By-products – Puckwah and Phool Kharee Salts

Henry Peddington had described and analysed about two by products of saltpetre i.e. Puckwah and Phool kharee salts.³⁰

The puckwah was mostly produced during the manufacture of saltpetre and was sold openly in the bazars for culinary purpose. The phoolkharee was manufactured from the efflorescence of the surface of various earths and was sold for feeding the cattle. There were three varieties of phool kharee salt. One variety was used for the purpose of adulterating

government salt. The total production of Kharee salt was 2 ½ lakhs of maunds. On the other hand the quantity of culinary salt was 50,000 maunds. The puckwah and phool kharee salt were used for adulteration. The Government appointed the chemists to detect the percentage of adulteration with the good saltpetre. From their reports it was found that a section of Nunias produced this Kharee salt for adulteration and also for feeding the cattle. The adulteration was a definite loss to the revenue of the government. Phool kharee salt was thrown to the market for adulteration.

Estimate of the Loss of Revenue from adulteration

	Maunds
Puckwah from manufacture of saltpetre	-2,50,000
From Phool Kharees	- 50,000
Phool Kharees sold for adulteration	-1,00,000
Total Maunds	-4,00,000

[Source : Henry Piddington, Journal of the Asiatic Society of Bengal Vol. 10 part 2, 1841]

Notes and references

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4. J. Stevenson, 'The Manufacture of Saltpetre, as practiced by the Natives of Tirhut', Journal of the Asiatic Society of Bengal, 1833 Vol. 2
5. Ibid.
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CHAPTER – 5

CONDITION OF SALTPETRE WORKERS (NUNIAS) AND THEIR REISTANCE TO BRITISH MONOPOLY.

The condition of the nunia or the manufacturer of saltpetre was very poor. Under the monopoly of the East India Company they were oppressed in various ways. They were made dependant on the Company by the system of advances. The economic condition of the nunia was depended on the demand of saltpetre. In the time of war there was great demand of saltpetre. At that time they had to produce saltpetre to a great amount. At that time they were economically benefitted. But in time of absence of war, many nunias were bound to become idle. Many of them were thrown out of employment.

The English East India Company's monopoly in saltpetre rendered its business illegal from person to other person. The nunias and Beldars made privately as much of this article as they could sell. As this meager quantity of saltpetre did not offer them opportunity for sufficient employment they engaged themselves to prepare culinary salt (muriate Soda) from saline earth. ¹

The Beldars of Purnea and the nunias of Saran, Champaran, Tirhut, Patna and Gaya ordinarily received advances from the Company's officials for the smooth running of their business. ² Some time these officials with connivance of the Mahtos stopped payment of these advances to the Beldars and nunias and this deprived them of their means of subsistence. ³ These poor and helpless manufacturerers of saltpetre were not only employed by the Company, but were prohibited from working for any other person.⁴ By the illicit business of the article, the Company was a considerable loser.⁵ When the investment of saltpetre was to be diminished, a certain amount of deduction was made from each factory and in each factory a few man would be

thrown idle and they would not readily find other employment.⁶ In 1802 nunias were forced to supply saltpetre on a very reduced price fixed by the officials of Singhia, Muzaffarpur, Kurhani, Darbhanga Mau, Chapra, Dighwara and Dumri Factories, which were the largest saltpetre depots in North Bihar. Further, the collector recommended that each nunia should be granted a patta specifically specifying as to what quantity and at what weight each nunia was to deliver his saltpetre. It was recommended with a view to stopping embezzlement and to protect the interest of the nunias. The collector also strongly recommended the appointment of Gomastas with their Amlas for each Kuthi (factory) in order to ensure faithful discharge of duty by Tehsildars. The manufactured saltpetre used to be divided half by half between the Government and the nunias and the Government was required to pay 2 annas from their own share to the proprietor of the soil, the payment being called Huck-Zamindary. This was true in respect of pargana Beesarah of Tirhut only. In other parganas of Tirhut the proprietors of the land were paid out of the nunia's share, the mode of collection of which the collector was not in a position of ascertaining the amount

inspite of his best endeavours. The government used to take all the saltpetre and pay money to other sharers. It is further mentioned that the saltpetre delivered by nunias used to undergo another process of refining before it was delivered to the commercial resident and in so doing every 1 ½ maunds of the commodity used to go down to only one mound in weight. But this was in no way detrimental to the interests of the nunias as they used to be paid before the second process.¹⁹ The weight was also differed at different stations of delivery.

From the beginning the nunias were subjected to numerous undue exactions. They paid to the Government half of their produce as sayer or tax for the manufacture of saltpetre out of which one fourth was paid to Zamindars on whose estates the kuthis were situated. Besides this, they had to pay selamy and russom to the kuthi under the following denomination :

Moostajeer Re. 1-0-0 Russom Canongo, Rs. 1-8-0, Zilladar, Re. 1-0-0, Barmottar Re. 1-0-0 Malerna Re. 1-0-0 and Pauslan Re. 1-0-0.

The mode of weightment was also very much objectionable. In pargana Beesarah of Tirhut saltpetre was received from the nunias at the rate of 17 seers to the pusseree and 48 seers to the maund which made 2 maunds 4 $\frac{1}{2}$ seers and 4 chattaks when delivered to the saltpetre factory of the Company by the farmer. In Tirhut proper, the rate was 17 seers to the pusseree and 40 seers to the maund which made one maund and twenty-four seers when delivered to the Company at 5 seers to the pusseree and 40 seers to the maund. Due to this over weightment the poor manufacturers were put to a great loss. In 1811 they presented a petition to the Court setting forth, in detail, the hardship they were exposed due to this excessive rate of the pusseree and unfair weightment. The Court after having considered their petition fixed the rate of pusseree at five seers on July 5 of the same year.

Mr. H. Parry, Collector of Tirhut, did not like this order and asked the Company's Vakil to make a motion before the Court of Appeal at Patna for the revision of the order of the Zillah Court concerning the fixation of the weight at 5 seers to the pusseree. The

Court of Appeal at Patna refused to modify the order passed by the Zillah Court although the Collector of Tirhut and the Commercial Resident were interested in modification of this order. This shows a glimpse of the independence of the Judiciary even in the beginning years of the nineteenth century. This judgement proved to be a boon to the indigenous manufacturers but it meant a heavy loss to the saltpetre farmers. H. Parry the Collector of Tirhut, went to the extent of advising the Revenue Board that the attention of the Vice-President in Council should be drawn towards this subject and under his authority an order might be issued to fix the old established pargana rate of 17 seers to the Pusseree. But no such order was passed by the Government and the order of the Zillah Court fixing the weight of five seers to the pusseree and forty seers to the maund, remained in force since then.

The nunias paid to the Government and the Zamindars a large part of their produce as sayer duty for the manufacture of saltpetre. So the advantage which the Government derived from the Namack Sayer Mahals cannot be denominated as land

revenue. It may properly be defined as a tax payable by the manufacturers of saltpetre for the liberty they enjoyed in respect of gathering saltpetre from the villages, ruined buildings, and other places where earth could be found impregnated with this article.⁷

The collection thus made from the nunias was known as the Namack Sayer and was an important branch of public revenue in Bihar. Although the sayer collection on Hat, Bazar, Ganj had been abolished in the year 1790 by the Company's Government, but sayer collection on saltpetre continued unabated. In a letter dated 20 March, 1795, G. Arbuthnot, Collector of Tirhut, described the Namack Sayer as a tax collected from the manufacturers of saltpetre as Haokmy Share.

After 1800 due to the increased demand of saltpetre in the English market the saltpetre manufacturers of Bihar were forced to accept advances on account of the Company. Even after the enactment of Regulation VIII of 1812, which re-established the saltpetre monopoly, the practice of forcing advances to the nunias continued. Besides,

the price given to the nunias for their hard earned saltpetre was extremely low which was not sufficient for their subsistence.⁸ The records of the period disclose that for one maund of saltpetre, the pykars received one rupee and 14 annas from the Company out of which the nunias were given only one rupee and six annas.⁹ But some times in 1813 and 1814 the price payable to the pykars was reduced to 1 Rupee and 7 annas out of which only 14 annas remained as the manufacturer's share. Due to this unremunerative price the nunias used to sold a portion of their produce to private merchants.¹⁰

In 1814 the nunias of Bihar submitted a petition to the Board of Trade praying for an increase in the price of the article.¹¹ Another petition was submitted by the nunias of Bihar which stated that the remuneration given to the manufacturers was extremely poor.¹² The petitioners also demanded direct dealings with the Company as it was in Malda. They complained that the pykars, who were the middlemen between the nunias and the Company, completely ignored the interests of the manufacturers. Not only that the petitioners also complained that the

pykars oppressed and exploited them in various ways. However the result of the petition was not impressive. The petitioners failed to get any redress of their grievances mentioned in the petition. ¹³

On 28th May 1812 another petition was presented to the Board of Trade by some nunias of other saltpetre manufacturers of Bihar. They complained against Government servants like Diwans and Gomastas. They also stated that the Commercial Resident paid no attention to their grievances. Not only that as a result of their complain against the Amlas of the Resident Office, they placed peons over them. Not only that this office had disgraced them. The Amlas also threatened them with serious consequence if they would make complain against them.

The Company's indigenous servants oppressed the nunias regularly. The inferior servants of the Patna Factory unfairly weighed their saltpetre and charged selamy from them on every occasion of weighment. The petition also stated that on drawing the attention of the Commercial Resident towards

these excesses of the Amlas, they were confined, beaten and disgraced by the peons of Resident's Office. At the end of the petition it was stated that such acts of oppression and tyranny had never been committed towards any class of people but the nuns of Zilla Behar within the domination of the Company. On 1st Sept. 1813 another petition was presented by the nuns which alleged that the Diwan had misappropriated government property to the value of six lakhs of rupees and that he might be immediately suspended by the government and extra-judicial enquiry commission had to be set up against him. The Enquiry Commission's examination of the charges against the Diwan was continuing for the last one year and a half and in the meanwhile a third petition was submitted by the nuns to the Register of the Diwani Adalat at Patna praying that they might be permitted to withdraw from further prosecution of the charges. Two more petitions were received by the Register for the withdrawal of the charges against the Diwan of Patna Factory.

On a critical examination of the charges against the servants of the Patna Factory it seemed that those

were true. But the petitioner's attempt to move the higher authorities against the arbitrary actions of their Diwan of Patna Factory and his Amlas was foiled by the desertion of some of their own men who were heavily bribed by the Diwan and were induced to submit counter petition on his favour. Possibly the complainant's patience had been exhausted by the annoyance and delay involved in carrying on the prosecution. But it may be safely concluded that the allegations against the Diwan and his Amlas were substantially true. The corruption of the Company's indigenous servants, and the oppression to the nunias were very much usual under the monopoly system. But after the end of the monopoly their conditions were improved to some extent.

The Nunias and the Organisation of Production :

The East India company established a network of saltpetre factories in Fatwa, Mau, Singhea and Chapra under the direct control of the sudder factory at Patna. Tirhut was famous throughout India for its

saline earth and Mau and Singhea factories were situated within its territorial jurisdiction.¹⁴ The district of Tirhut then comprised the modern districts of Muzzafarpur, Sitamarhi, Madhubani, Samastipur, Darbhanga and large part of Monghyr. Singhea factory was well known for producing a huge quantity of saltpetre.¹⁵ The factory at Mau was also famous in the district of Tirhut. The company's factories at Chapra and Fatwa were equally important for saltpetre production. Actually, saltpetre was not manufactured in these factories but they served the purpose of refinery and godwons. Crude saltpetre was purchased from the Nunias by the Company through contractors and dalals who were known as mostajeers.¹⁶ The mostajeers received advances from the Resident. Their duty was to collect the saltpetre from the Nunias and deliver it to the Resident at a fixed price. But this system caused considerable delay and inconvenience. A new system was introduced. In lieu of mostajeers three principal gomastas were appointed in three principal factories at Chapra, Mau and Singhea. As a result the mostajeers were left without employment. They presented a petition to the Resident praying for their

restoration. The Commercial Resident granted their appeal. The order firmly entrenched the position of the moostajeers who continued to collect saltpetre from the Nunias till the year 1814 when the saltpetre monopoly of the Company was abolished.¹⁷ The end of monopoly was a great relief to the nunias who had suffered much under this system and since 1814 they were at liberty to sell saltpetre to the highest bidder or to any other purchaser whom they liked. This led to the influx of a large number of saltpetre traders in the rural areas and a sudden rise in the prices of the article.

During the monopoly period the Company advanced money to the nunias not through the paid servants or gomastas but through the dalals.¹⁸ The amount of advances varied according to the political intuation in India and Europe. In 1792, the Company obtained only 1,78,000 rupees worth of saltpetre from Bihar, but during the Revolutionary and Napoleonic wars in Europe the demand for this article increase in Englad. The total provision of Bihar saltpetre on account of the Company from November 1798 to October 1799, thus amounted to 1,50,000 maunds,

the value of which was Rs. 3,28,000. ¹⁹ However in 1802 the numias were forced to supply saltpetre on an very reduced price to the officials of Singhia, Muzaffarpur, Kurhani Darbhanga, Mau, Chapra Dighwara and Dumri factories, those were the largest saltpetre depots in North Bihar. These poor and helpless manufacturers of saltpetre were employed by the Company and they were prohibited from working for any other person. From the beginning of the season the Nunias were subjected to numerous undue exactions. They had to pay to the government half of their produce as sayer or tax for the manufacture of saltpetre out of which one fourth was paid to the Zamindars on whose estates the kuthis or saltpetre factories were situated. The Nunias had to pay selami and russom to the kuthi officials under the following dominations :-

Moostajeer – Re-1-0-0, Canongo Re – 1-8-0, Zilladar Re -1-0-0 and Barmottar – Re-1-0-0, Malerna – Re- 1-0-0, and Paulsan – Re-1-0-0. ²⁰ The mode of weighment was also very much objectionable. Due to overweighment the poor manufacturers were put to a great loss. In 1811 they presented a petition to th

Court setting forth, in detail, the hardship they were exposed due to excessive rate of pusseree and unfair weightment. After 1800 due to increased demand of saltpetre in the English market, the Nunias of Bihar were forced to accept advances on account of the Company. After the re-establishment of monopoly, the practice of forcing advances to the Nunias continued. Besides, the price given to the Nunias for their hard earned saltpetre was extremely low which was not sufficient for their livelihood. For one maund of saltpetre, the Nunias were given only one rupee and six annas. Due to this unremunerative price, the Nunias used to sold a portion of their produce to private merchants. In 1814 the Nunias of Bihar submitted a petition to the Board of Trade praying for an increase in the price of the article. Another petition to the Board of Trade praying for an increase in the price of the article. Another petition was submitted by the Nunias of Bihar which stated that the remuneration given to the manufacturers was extremely poor. The corruption of the Company's indigenous servants and the opporessions to the Nunias were very much usual under the monopoly system.

The Nunias of North Bihar and the Beldars of Purnea received advances from the Company for smooth running of their business. Four persons were required for proper maintainance of one saltpetre Kuthi – three men and one women. The task of three men was to collect and lixiviate the fuel and manage the fire. Such type of family was advanced Rs. 40/-. ²¹ This was a very poor remuneration for four persons for their labour of six months. A male family of four persons made 20 to 30 maunds of saltpetre in one season. The small remuneration forced the Nunias to involve themselves in illicit trade of slatpetre. The low price given by the Company had induced the nunias to practice every specie of adulteration.

The Numias were forced to accept advanced from the Company in time of increasing demand of saltpeter in the English market. Even after the enactment of Regulation VII of 1812 which re-established the saltpetre monopoly the practice of forcing advances continued. ²² In 1812 for one maund of saltpetre the paikars received one rupee and fourteen annas from the Company, out of which the Nunias got only one rupee and six annas. Sometimes in 1813 the price

payable to the paikars was reduced to one rupee and seven annas per maund out of which only fourteen annas remained as the Nunias share. Due to this unremunerative price the Nunias sold a portion of saltpetre to private merchants.²³

Since 1770's Nunias paid to the government and the Zamindars a large part of their produce as 'Sayer' for the manufacture of saltpetre.²⁴ So the advantage which the government derived from the Nimak-sayer mahals cannot be denominated as land revenue. It may properly be defined as a tax payable by the manufacturers of saltpetre for liberty they enjoyed in respect of collecting raw materials from villages, ruined buildings, and other places where earth could be found impregnated with the article. The collection thus made from the Nunias was known as Nimak-sayer.

Various kinds of saltpetre

The crude nitre was dissolved in water and it was freed from many impurities. It was again

evaporated and the Kulmi saltpetre was produced. Khari Nimak was produced through difficult process. The brine procured by filtering water through the earth was called Ras. This was evaporated in earthen pots of hemispherical form. Six for each kuthi were supported contiguous to each other in two rows, over a cavity in the earth that served as a fire place, and the fuel was thrust under by a small slope at one end while the smoke went out by an opening that was formed opposite. When the brine was boiling, a woman who attended the fire stirred the pots occasionally with a small broom, fixed at right angles to a stick.²⁵ This removed the froth called sithi and greatly increased the quality of nitre, but it was made into a kind of salt called khari nimak. Culinary salt was also called as Beldari Nimak. In Tirhut, Saran, Patna, Gaya, Monghyr, Bhagalpur and Purnea the Nuias scrapped off the raw material from old houses, mango groves etc. and lixivated and poured the brine on some straw. The Nuias allowed it to evaporate when the straw was found to be covered with a saline efflorescence. The straw was then burned, the ashes were lixivated and the brine evaporated to dryness. The result was the Beldari Nimak which was a very

impure material. ²⁶ The Nunias of Patna and Gaya prepared a kind of salt called Dhar Nimak. This Nimak was compared to the Beldari Nimak of Purnea or Khari Nimak of Tirhut. About 566 furnaces of Patna and Gaya produced about 8000 maunds of crude nitre in a season. ²⁷ In the first quarter of the 19th century there was a large number of Kuthis in Saran, Champaran, Tirhut, Gaya and Sahabad. In 1793 there were 385 Kuthies but in 1804 their number rose to 557. ²⁸ North Bihar was the principal centre of Khari Nimak. In 1793 there were 29, 41 and 15 Kuthis for Khari Nimak in the districts of Tirhut, Saran and Champaran respectively. It was chiefly used as a medicine for cattle. There were three kinds of Khari Nimak. The whitish khari Nimak was called dhulkari and was generally given to the cattle. The second type was called sindur khari. It was more impure salt and this was used in the preparation of red lid. The third kind of khari nimak was called Chamari Khari (Black soild Mass). It was used by tanners and was sold at the rate of 112 seers for one rupee. ²⁹

There were other varieties of saltpetre The culmi saltpetre was very costly. It was taken from the

Nunias at the rate of Rs. 1-13-0 per maund. The rate of cooliah saltpetre was 1-11-6 per maund bowah saltpetre at the rate of Rs 1-7-0 and Cutcha saltpetre at the rate of Rs 1-4-0 per maund. ³⁰ It is to be mentioned that Khari Nimak was not prepared in Purnea, Monghyr, and Bhalgalpur in a large quantity. It was produced largely in North Bihar. The Khari Nimak was an impure sulphate of soda, and could not be used as food. It was highly useful as a medicine both for men and cattle. ³¹

Culmi Treble Refined Saltpetre : Superior quality

The best and superior quality of saltpetre was called Treble Refined Culmi saltpetre. It was costlier than ordinary saltpetre. Actually it has been refined for three times which increased its quality. In 1798 the Company's officials made a comparative study of the cost of treble refined saltpetre with that of ordinary saltpetre. ³² The cost of Treble refined saltpetre was per factory maund including all charges and commission.

Treble Saltpetre = S Rs. 2-13-5 ¼

Ordinary saltpetre = S. Rs. 2-4-9

Difference 0 – 8-8 ¼

I. Fleming, Inspector of Ware House, sent a report to Export Ware House Keeper on Patna treble refined saltpetre. He argued that the difference or extra cost of 8 annas per factory maund might be compensated by the superiority of its quality. He also said that from the point of view of comparative fineness and strength the treble saltpetre crystal was excellent. ³³ Fleming also reported that the extra cost in producing treble saltpetre will be compensated by a higher selling price in England which was Sixteen Rupees 5-8 annas per maund. There was great demand for treble saltpetre among the dealers of England. ³⁴

Culmi Treble Refined Saltpetre Despatched from the Following Factories on 5th November, 1798.

Singhea	=	25 Bags containing 50 Mds. 1 Bag containing 1md.
Chapra	=	28 Bags containing 56 Mds. 1 Bag containing 1 Mds.

Mow = 28 Bags containing 56 Mds.
 1 Bag containing 25 Mds.
 Total = 84 Bags containing 164-25
mds.

[Source : Board of Trade (Commercial) Progs. Vol.
139, Part I, 1798]

Hindrances to manufacture saltpetre

The gomastas were in charge of organizing manufacture of saltpetre. They had direct linkage with the producers or nunias. But they had to face many problems in doing their job. Sometimes they were compelled to be involved in clash with the Indigo planters in case of collecting grass and wood which was necessary as fuel for boiling the raw saltpetre brine. In Bojipore of Bihar, the gomastas complained to the Judge and Magistrate of Sahabad that collection of grass from the jungles was a long established custom for 40 years without any interruption. But the indigo planter prohibited the gomasta's people to collect grass and erect Kuthis for boiling saltpetre. The gomastas complained that due to interference of the indigo planter, the boiling of

saltpetre had been completely stopped which would be detrimental to the supply of the commodity in time. The Commercial Resident of Patna stood in favour of the gomastas. The indigo planter took possession of the jungle. They demanded tax from the gomastas. But they protested and argued that collection of grass was the customary right of the nunias for long years. Not only that the indigo planter did not allow the nunias to boil saltpetre in their old kuthis.

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CHAPTER – 6

SALTPETRE TRADE IN INDIA IN PRE-MONOPOLY PERIOD AND IN THE BENGAL PRESIDENCY IN MONOPOLY PERIOD UNDER THE EAST INDIA COMPANY

In pre-British period or in the Mughal period saltpetre trade in Bengal was subjected to frequent interference on the part of the Mughal authorities and such “Official interference” was one of the difficulties in the trade. There was everywhere the tendency on the part of the provincial governors and the officials to interfere in the saltpetre trade. Administrative changes like new appointments and transfer of officials etc. affected the course of saltpetre trade.

A. Saltpetre Trade in India in pre-Monopoly Period :

B.

In the 70's of the 17th Century Ibrahim Deputy of Shaista Khan. ¹ Due to excess of Ibrahim Khan the English closed their Patna Factory in 1676 and lived in hired houses.² In November 1679, Job Charnock gave the Nawab a present of Rs. 2,000 and Rs. 700 to Mir Bahri (Lord of Admiralty) and got clearance orders for the saltpetre boats to be dispatched to Calcutta. ³ After 1680 the Dutch became a crucial factor in the sea. They purchased huge quantity of saltpetre in Bihar and exported it to their home market.⁴ In 1700, Murshid Quli Khan, as Diwan of Bengal, tried to control the saltpetre trade of Bihar. During the period of Farruksiyar (1712 to 1727) the Dutch became the principal trade of Bihar saltpetre. After the death of Murshid Quli Khan, his son-in-law Shuja Khan ruled as the Nazim of Bengal, Bihar and Orissa till 1739. During this time there was a keen competition between the Dutch and the English in the field of saltpetre trade. After his death, his son Sarfaraz became Nawab of Bengal. But he was

overthrown in 1740 by Alivardi Khan who ruled till 1756.

During the rule of Alivardi Khan, Patna had developed into a very busy centre of trade for saltpetre.⁵ By 1750 most of the saltpetre exported by the European companies was manufactured in Bihar.⁶ The Dutch and the French, who also had their factories at Patna, were the rivals of the English in the saltpetre trade. The Englishmen of Patna factory were involved in a quarrel with the Dutchmen regarding the purchase of saltpetre. But the dispute was settled amicably with the interference of the English President and Council at Calcutta. In 1740, more than 25,000 bags and in 1742 more than 18,000 bags of saltpetre were sent to Calcutta from Patna.⁷ In 1744 the English factory at Patna persuaded the Dutch and the French to keep down the price of saltpetre. Before 1757 the East India Company tried their best to gain absolute control over the saltpetre farm in Bihar. The Company reached their goal on the occasion of a dispute between the servants of Khwaja Wajid, a saltpetre contractor, and those of the English Company's factory at Patna. Clive took this

opportunity to request the newly installed Nawab Mirjafar, for granting the saltpetre farm to the English Company as the only means of preventing such disputes in future. They offered the highest terms at which the farm had even been rated. The Parwana ran thus : “at this time through the means of Colonel Clive the saltpetre land of the whole province of Bihar have been granted to the English Company from the beginning of Bengal year 1165 in the room of Coja Mohamed Wazeed, you are therefore hereby directed to establish the authority of three Gomastas in all the saltpetre lands of the aforesaid province, to give strict orders to the saltpetre picars not to sell and ounce of saltpetre to any other person and to receive from the Company the stipulated nuzzerana and money for the aforesaid lands.”⁸

In the first half of the 18th century or before the establishment of the British monopoly, the saltpetre trade was mainly dominated by the English, the French and the Dutch. There was a co-existence of competition and co-operation between the Dutch and the English powers. Both of them tried to collect as much saltpetre as possible for war purposes. Patna

was a centre of trade for cloth, opium and chiefly saltpetre. Most of the saltpetre exported by the European Companies was manufactured in the province of Bihar. The Dutch and the French, who also had their factories at Patna, were the rivals of the English in this saltpetre trade.

There was a keen competition among the European powers for the purchase of saltpetre. In 1739 men of the English factory at Patna had a quarrel with the men of the Dutch factory there concerning the saltpetre bought jointly, which was seized by the Dutch with an armed force. As the disputes growing acute, the English President and Council in Calcutta applied privately to the Dutch Directorate at Hugli, and the matter was then amicably settled by June of the same year.⁹

On 29th August, 1739 the Patna factory sent a fleet to Calcutta with 18603 bags of saltpetre and in October another fleet with 6500 bags more.

In 1742 the Patna factory of the English gave hopes of 5600 maund saltpetre and promised its

authorities in Calcutta that it had 10258 maund in warehouse and had supplied Madras with 1800 maunds and was sending 3800 maund more.¹⁰

About the beginning of 1742 the authorities in Calcutta received from Patna only 12212 bags saltpetre invoiced at 4 rupees a maund.¹¹ The Company had to suffer troubles on account of Mr. Cole's maladministration of the Patna factory and his behaviour towards Omichand, Deepchand (brother of Omichand) and others.¹²

The English factors at Patna tried to persuade both the Dutch and the French to keep down the price. The Dutch Directorate at Hugli expressed its willingness to enter into agreements with the English for the purchase of saltpetre, but the French insisted on 25000 Maunds yearly. The Dutch desired the French might have only 25 percent and the French had no right to more. But the French remained persistent in their demands.

Drabbe, the Dutch Chief at Patna, agreed to purchase saltpetre and to give the Three Nations their

usual proportions for saltpetre at 3 rupees 4 annas sicca per Maund. On the 2nd of January, 1745, the Patna factory sent 6094 bags of saltpetre to Calcutta.

But the troubles about the accounts of Omichand, Deepchand and others remained yet unsettled. So Omichand and Deepchand resolved not to allow the English to purchase a seer of saltpetre and offered at the Nawab's darbar 25000 rupees to compel the Europeans to buy solely of them. At this the President of the Council in Calcutta wrote to the Chief of the Patna factory advising him to "act in conjunction with the Dutch" and not to 'advance a Rupee to Assamis." The entrance of another Maratha invading army into the province of Bihar via Patna, during the rainy season of 1745, created fresh troubles for the Company's trade. The Marathas plundered Futwah and burnt a godown, where 7186 maunds of saltpetre were deposited. However, Drabbe, the Dutch Chief at Patna, agreed to provide saltpetre for the year 1746 agreeable to the last year's contract at 3 Rupees 4 annas a maund. The English Company's authorities in Calcutta agreed to this and directed Patna to engage by contracts or with ready

money . In 1746 the East India Company was in need of more saltpetre as they collected only 21274 mds. The Company took the help of the Dutch to get more salt by making contract with Deepchand. The Dutch authorities advised the English to act unitedly for getting more saltpetre.

The English factory again fell into troubles with the Dutch Chief for the latter's demanding all the money, as arranged in the contract, for the purchase of Deepchand's saltpetre.

The Dutch at Hugli agreed to give the English their true proportion at Hugli provided the English kept to the Letter of the contract in regard to Deepchand's last year's saltpetre and also agreed to partake in all charges of bringing it down and in the risk proportionable to the quantity. The English agreed to this. But very soon the co-operation between the Dutch and the English Company disappeared on the issue of purchasing Deepchand's saltpetre at Patna. Deepchand, the Assami and the local Indian merchant-contractor, secured permission from the Nawab's government by giving Rs. 10,000/- to sale

saltpetre at high price. Although the Dutch agreed to purchase on Deepchand's price, the English Company refused to accept the proposal of the Dutch.

In view of these troubles, the order of the authorities in England was for the withdrawal of the Patna factory and for the purchase of saltpetre wherever it could be available. The English Company became indifferent to the saltpetre business at Patna, and so they remained silent.¹³ However the Dutch tried to make further negotiation with the English for purchasing Deepchand's saltpetre. But the Calcutta Council of the E.I. Company made suitable contract with Omichand which was approved by the Court of Directors.

Accordingly a contract was made with Omichand on the following terms "I, Omichand, merchant of Calcutta do hereby agree with the President and Council on account of the Hon'ble East India Company, to deliver them in Calcutta the full quantity of 51,000 Factory maunds of Patna Dobarra saltpetre at A. Rs. 5-12 per Factory Maund upon the following terms. To have nine per cent interest

allowed me upon the whole amount A. Rs. 2,93,250 from the 17th May, 1753, and for what sums advanced me from the Company's treasury I shall give receipts. In the month of September I will deliver into the Company's godown maunds 20,000 and the remaining 31,000 by the 1st February, 1754, and if the whole quantity be not delivered into the Godowns by that time, I agree to pay the penalty of 10 p.c.”¹⁴

Besides due to the pressing demand for saltpetre from England, the Bombay and the Madras Councils also wrote to the Council in Calcutta in January 1757 for dispatching saltpetre to their respective places; the former for 500 tons and the latter for as large a quantity of that article as could be procured. But the President procured with great difficulty only 800 bags of saltpetre at Chinsura. After capturing Chandernagore, the English applied to the Dutch Directorate at Hugli to make a contract with them for 60,000 maunds of saltpetre but they received no definite answer. Therefore, they agreed to take from Omichand 20,000 mds at 6 A. Rupees per maund and Calcutta Council sent to Madras 800 bags.

The English tried to gain absolute control over the saltpetre farm in Bihar. After the installation of Mir Jafar as the Nawab of Bengal, disputes arose between the servants of Khawja Wajid and those of the English Company's factory at Patna.

To solve the problem Clive requested the Nawab for granting the saltpetre farm to the English Company. After much hesitation the Nawab agreed to the proposal 'reserving the receipt of 20,000 maunds or 1,600,000 pounds weight a year for his own use.' The Dutch protested against the grant, whereupon Clive produced a letter showing that they had tried to have the farm for themselves from Sirajuddaulah also. However, the English agreed to supply them (the Dutch) with the quantity they wished to purchase. The Dutch tried to create some troubles for the English farm. But the English triumphed at last and by the year 1759 they commanded the saltpetre market.

In the first half of the 18th Century there was co-existence of competition and co-operation between the Dutch and the English in saltpetre trade. But when Robert Clive came into the picture in 1750's the East

India Company had dominated the saltpetre trade with the help of the Nawab of Bengal.

B. Saltpetre Trade in the Bengal Presidency in Monopoly Period under the East India Company

The English East India Company established their monopoly in saltpetre trade on 11th June, 1793. A public notice was issued which stated “that all saltpetre already embarked for exportation in any ship or vessel in this river (Hooghly) whether belonging to British subjects or Foreigners should be forth-with relanded in seven days under pain of seizure and confiscation.”¹⁵ Thus the export of saltpetre on the part of the private persons was totally prohibited. However, the saltpetre trade of the Company was a Government monopoly only between 1793 and 1811, and between 1813 and 1814. For the rest of the period it was permitted to be carried on by private persons as well.¹⁶ But why did the Company establish their monopoly in 1793 ? It was due to the outbreak of the French Revolutionary War in Europe in 1792. The

possibility of England being involved in it, increased the demand for saltpetre in the British market. On 20th December, 1792 the Secretary to the Court of Directors wrote a letter to the Governor - General-in-Council of the Bengal Presidency that greatest importance should be taken for providing and sending saltpetre to England.¹⁷ The attention of the Bengal Government was drawn at the same time to the expediency of preventing the foreign nations from receiving a greater quantity of the article which they were entitled to. On the declaration of war against England by France early in 1793 the Secret Committee of the Court of Directors sent prompt note to the Governor –General for dispatching 400 tones or more of saltpetre in any of the early returning ships as early as possible after the receipt of the letter.¹⁸

With the partial opening of the East India trade to private enterprise by the Charter Act of 1793 the restriction against the export of saltpetre by the British subjects was removed to some extent, and they were permitted to send the article to England by the Company's ships. It may be noted that during the period 1794 to 1810 more than 320,000 pounds

weight of saltpetre was exported to England from Calcutta by the private and privilege trade, besides what was sent on the Company's account.¹⁹ The prohibition against export by foreigners and to foreign countries no doubt, remained in force for some years.

Before long the rule against the export of saltpetre to foreign countries and by foreigners was waved in favour of neutral nations like the Danes and the Americans. Already before 1802 Bengal saltpetre was a leading export to America, while from 1800-1801 it was almost regularly exported to Denmark, except during the years when England was at war with that country. Licensed individuals were permitted to export it also to China upon their furnishing a security that it would be landed in China, and disposed of to the Chinese only - a privilege which appeared to have been enjoyed mostly by the Calcutta Agency Houses. In the Company's records there is a reference to a Portuguese merchant of Macao being permitted to export Bengal saltpetre to China, subject to the condition of selling it to the Chinese only. But that was only a special indulgence of the Government.²⁰

Towards the end of the eighteenth century, and in the beginning of the nineteenth, as indeed from long before, almost a regular supply of saltpetre was required at the subordinate Presidencies of Bombay and Madras on account of the Company's wars against Mysore and the Marathas. But it was always fluctuating. Thus in 1805, by which year hostilities with the Marathas terminated for the time being, the total value of saltpetre exported to Bombay was only 3,900 sicca rupees, while the export to Madras in the same year was worth not more than 4,373, sicca rupees. A large quantity of* saltpetre, on the other hand, was shipped for Bombay in the year 1810, though there was actually no war in South West India at the time. ²¹

The Government of Bengal, in fact, it appeared, was not very anxious to maintain its exclusive right of manufacturing saltpetre, probably because the saltpetre monopoly was not a regular source of revenue like opium or salt. Thus in 1803-04 discussions arose between the officers of judicial and commercial departments regarding the extent of the Company's right to the exclusive provision of the article. On that occasion the Governor-General-in

Council, while admitting that sole privilege of manufacturing saltpetre had been vested in the Company during a long course of years, instructed the Board of Trade to prepare a draft of a regulation for the future provision of the article. But nothing was done to carry out this order, and the further consideration of the subject seemed to have remained in abeyance till 1810. In that year, the Board of Trade, of its own account submitted to the Government the draft of a regulation intended to enforce the strict exercise of the saltpetre monopoly.

The question of the Company's saltpetre monopoly re-appeared in 1811 when it was brought to the notice of the Government that the Commercial Resident at Patna had stationed peons to prevent the entrance of any saltpetre into the city of Patna, except on account of the Company. The Vice-President-in-Council in the Revenue Department took this opportunity to record his opinion that the action of the Commercial Resident was contrary to the principles laid down by the Governor-General-in-Council in 1810. It was ordered that the Board of Trade, the Judge and Magistrate of Saran and all other Judicial authorities

under the Government of Bengal should henceforward decide cases regarding the provision of saltpetre according to the principle of the regulation governing the supply of piece-goods. Thus the exclusive right of the Company to manufacture, and trade in saltpetre was for all practical purposes abandoned in 1811.

The Governor-General-in-Council thereupon rescinded the unofficial order of May, 1811, which had declared the saltpetre trade free, and enacted a regulation resuming the monopoly on the part of the Company with a view to securing to Government all the saltpetre of the Bengal provinces. The regulation took effect from the 1st October, 1813.

Then came the Charter Act of 1813, which abolished the Company's monopoly of the East India trade. Under Section 21 of this Act, they were relieved from the obligation of delivering a fixed amount of saltpetre annually to His Majesty's stores in England. Thereupon a regulation was issued by the Governor-General-in-Council on the 11th March, 1814, repealing Regulation VIII of 1812, by which the Company had

resumed the monopoly of saltpetre manufacture in Bengal. ²²

Volume of Trade

During Company's monopoly the volume of trade and production of saltpetre varied according to the needs or situation of the war. From the archival records it is found that the exact weight of saltpetre was not specifically mentioned. In lieu of it, the records mention only quantity of bags containing saltpetre. But weight of the Bag was also varied. It is not clear how much weight of saltpetre was contained in one bag. Sometimes the total weight of 200 bags was 2 lakh maunds of saltpetre. But in other cases the same quantity was contained in 300 bags. From the proceedings of the Board of Trade (Commercial) it is found that in January 1794 the Company sent to England 200 tons of saltpetre ²³. They also sent 30,000 mds of saltpetre of which factories of Chapra produced 13,000 mds, Singhia 13,000 mds and Mou 4,000 mds in 24th March 1794 ²⁴. From the records of 1795 it is found that the volume of saltpetre produced

in some factories of Bihar was 7,000 mds.²⁵ From the proceedings of the Board of Trade on 14 Nov. 1794 it is found that the ship 'Britania' carried more than 161 tons of saltpetre to England.²⁶

From Export Ware House report of 1805 it is found that 3,000 Bags of culmii saltpetre were exported to England on 3rd September. It is also found that in different months, for example, on 7th September, 1805 7,000 bags, in November, more than 34,000 bags were sent to England.²⁷ In February, 1810 the Company collected saltpetre amounting Rs. 8,74,000 sicca rupees, and 228 tons of saltpetre was sent in 9th March 1810. In 1810 the total quantity of saltpetre was 4,226 tons.²⁸ In April 1814 the of saltpetre of 32, 778 maunds were collected in ware house.²⁹

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13. Ibid May 24, 1753
14. Orme, Vol II, P 282
15. Board of Trade (Commercial) Progs. Nov, 25, 1793

16. H.R. Ghosal, op. cit, P.138
17. Board of Trade (Commercial) Progs. June 13, 1793.
18. Ibid, Nov. 25, 1793
19. Milburn, Oriental Commerce, Vol. II, P128
20. Board of Trade (commercial) Progs. Feb 25, 1806
21. Milburn, op.cit, P. 138-139,ma, Early in 1810, about 10,000 mds of saltpetre was sent from Calcutta to Bombay (Home Deptt. Public Consultations, April 27, 1810)
22. Harrington, An Elementary Analysis on the Laws and Regulations, Vol. III, P221.
23. Board of Trade (Commercial) Progs. March 6, 1894.
24. Ibid, March 24, 1894
25. Ibid, March 6, 1795
26. Ibid November 14, 1794
27. Ibid November, 1805
28. Ibid, March 1810
29. Ibid April 22, 1814.

CONCLUSION

The thesis claims its importance not only in the field of economic and military history, but also in the history of science. The novelty of the thesis is its environmental analysis on various aspects of the production of saltpetre. The collection of raw materials and manufacture of saltpetre was almost totally depended on environment. The raw materials for making saltpetre could be found in particular areas of Bihar with the help of a peculiar kind of climate and soil. The thesis has analysed the nature and varieties of particular type of soil favourable for saltpetre production. Actually not much has been written on saltpetre industry and the available writings have mostly concentrated on saltpetre trade rather than organization of production and role of environmental in it. The thesis has tried to tap this neglected area of saltpetre industry and to throw new light by giving importance to environment or climate in different stages of saltpetre production i.e. from collection of raw materials to finished production of saltpetre crystals. The collection of raw materials from soil,

preparation of salt beds, storage of raw materials on old mud walls, making of fitter and boiling house, process of boiling – all these were depended on environment. This dependence on environment was an age-old practice in making saltpetre by indigenous method. The thesis has tried to analyse this environmental situation as far as possible.

The chemical analysis of all types of materials and particles available in different processes of manufacturing saltpetre has been done in detail in the thesis. No historian could think about it in their writings on saltpetre. The thesis has given in detail the chemical composition of different types of soil, raw materials such as urinemixed soil and efflorescence in mud walls, the water used in manufacturing saltpetre, raw materials after filtration, and after boiling, water in the saltpetre beds and finally the finished form of saltpetre crystals. This is a humble attempt of the thesis to throw new light on saltpetre industry. The chemical analysis showing chemical composition of the materials in the process of manufacturing saltpetre will enrich our knowledge of history of science.

The British utilised the Indian saltpetre in building up their empire. The quality of Indian saltpetre was superior to any saltpetre of the world. Therefore, there was a great demand of Indian saltpetre in world market. By imposing monopoly on saltpetre industry the British controlled the production and trade of this important commodity which was very much needed in the battle field. As the Indian saltpetre possessed additional ballistic strength, it was easy for the British to dominate in European war. The gunpowder made from Bihar saltpetre was enormously utilised in Napoleonic war. The Bihar saltpetre brought tremendous success for the British in their war against Napoleon. Apart from military purpose, the British had economic interest. They amassed great fortune from saltpetre trade which contributed much to the formation of British imperialism.

As a war commodity saltpetre had great importance throughout the world in medieval and modern times. It was an essential ingredient for making gunpowder. The manufacture and use of saltpetre had its antiquity in India before the coming of

the Mughals. But the Mughal rulers utilised it extensively in consolidation and extension of their empire. The saltpetre industry was therefore flourished throughout India during the Mughal rule. For this reason, the Mughal empire can be called 'the gunpowder empire'. By its special characteristics, saltpetre was totally different from other important industries in India like cotton, silk, opium, indigo and salt. As these industries were sources of revenue, they had economic importance during the British rule in India. But saltpetre on the other hand, had military importance, although it had scope for foreign and inland trade. The growth and development of this industry was depended on the exigency of war. Therefore the fortune of the saltpetre producers was also fluctuated during times of war and peace. In times of peace, they had almost lost their business and they were forced to become idle.

The conception about limited utility of saltpetre has been changed thoroughly by this research, as it is found that this commodity was used for different purposes such as cooling, refrigeration, preservation of foods etc. Our knowledge has been extended by

getting information about internal uses of saltpetre in addition to its use for making gunpowder and for blasting.

Saltpetre was manufactured in different centres throughout India. The Mughal rulers depended very much on Ahmedabad saltpetre. Although they did not give much attention to Bihar saltpetre, the European Companies in India made no mistake in utilising it. They established the fact that saltpetre under this region of the Bengal Presidency was best in quality and cheapest in price. For this reason the East India Company's government relied mostly on Bihar saltpetre. They established their monopolistic control over production and trade of saltpetre and tried to oust the Dutch from this trade. It must be noted that saltpetre was a commodity for both internal and international trade. There was a regular movement of saltpetre throughout India as a commodity for internal commerce.

The Mughal monopoly on manufacture and trade of saltpetre was not strictly enforced. In the 17th century regional enemy states of the Mughals like

Bijapur and Golkunda established their own monopoly over the production and trade of this commodity. Not only that the Regional Mughal Governors and other officials had oftenly relaxed the restrictions in purchasing and transportation of saltpetre by taking bribes from the European Companies. Large-scale corruption among the higher Mughal officials made it impossible to impose strict monopoly particularly during the rule of later Mughals.

It is very interesting and curious to inform that raw materials for making saltpetre was prepared with cow's urine. In many parts of Bihar it was a regular practice. The Nunias faced various difficulties in the process of collection of cow's urine. The mixture of this urine with a particular type of soil, prevailed in some parts of Bihar, was congenial for preparing raw materials. There was also other process in collection of raw materials. It was basically the gift of ecology to some particular places of Bihar. During the manufacturing season a lair of nitre had been stored on the walls of the mud houses and old buildings, the nunias scraped it as raw materials for making saltpetre. The quantity of this type of raw materials

depended totally on environmental situation. In uncongenial weather the quantity of collection of raw material was bound to fall.

During East India Company's monopoly the nunias or saltpetre producers were much oppressed and exploited than before. The system of advances was coercive to them. They were paid very low wages. The amount was so small that they were compelled to sell saltpetre clandestinely to private dealers. Therefore smuggling in saltpetre was the result of poor payment to the producers. The smuggling of saltpetre can be treated as a form of protest of the nunias to Company's monopolistic control on the commodity. At the same time it is to be noted that manufacture of saltpetre was a part-time business of the nunias. They were primarily agriculturists.

In pre-colonial period some wealthy indigenous merchants were involved in production organization of saltpetre. They were called Assamis. Prominent merchants like Omichand and his brother Deepchand were closely involved in manufacture and trade of

saltpetre. They were so powerful that they dictated their own price in selling saltpetre to the European Companies. Advances to the nunias were paid through these Assamis.

Finally, it is clearly revealed from the archival records that Bihar saltpetre was enormously utilised by the British Government in French Revolutionary war in Europe.

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Fort William the 20th July 1799

Export Warehouse Keeper between the 1st of May
and the 30th of April 1799, Amounting to 54,189 1/2

Fort William
Accountant Gen^l Office
the 17th of July 1799

I have the honor to be
(Signed) Tho^s Myers

Act^g Gen^l

Account of Salt Petre delivered for the use of His
Highness the Nabob of Moorshedabad.

In 1789/90 Salt Petre	M ^{ds} 1,000	29 6
" 1790/91 Ditto	1,000	22 4
" 1794/5 Ditto	4,000	94 1
" 1797/8 Ditto	1,000	21 5
" 1798/9 Ditto	1,000	21 5
M ^{ds} - 8,000 S ^r N ^o 18362		

Fort William
Accountant Gen^l Office
the 17th of July 1799

Errors Excepted
(Signed) Tho^s Myers
Act^g Gen^l

Account of Salt. Peter determined for the use of the
Highness the Sabot of Moorshedabad.

In 1789/90 Salt Peter	M ^{rs} 1000	236
" 1790/91 Ditto	1000	224
" 1794/5 Ditto	4000	942
" 1797/8 Ditto	1000	215
" 1798/9 Ditto	1000	215
	M ^{rs} - 8000	S ^r M ^r 1834

Erasmus Excerpt

Port William

Mangrove Oil	946.33	9	1608.5
Shell Lard	363	15.3	7,630
Lard	265.5	8.3	4,681.19
Sugar	56,850	part Est'd 1896	415,000
Salt Petre	58,828	1960.19	14,000
Total			337,698.62

Port Warehouse
 September 1896
 Sam H.
 Thos. Abnham
 J.E.W.H.

Measurements of the Liverpool Warehouse -

Diameter Diameter Thickness
at at of the Depth
Top Bottom Bottom
Feet Feet Feet Feet

101	1	Topper	Butter	---	---	3.	1.	10.	3/4	1.	4
2	1	Doth	---	---	---	3.	3.	1.	10.	7/8	1.
3	1	Topper	Bottom	---	---	3.	1.	2.	10.	1/4	---
4	1	Doth	---	---	---	do	---	do	---	do	---
5	1	Doth	---	---	---	2.	11.	2.	8.	3/16	4.
6	4.	Doth	---	---	---	do	---	do	---	do	---
7	1.	Doth	---	---	---	3.	1.	3.	---	1/4	---
8	1.	Doth	---	---	---	2.	11 1/2	2.	8 1/2	---	---
9	1.	Doth	---	---	---	2.	11	2.	8	---	---

Mr. J. Stewart

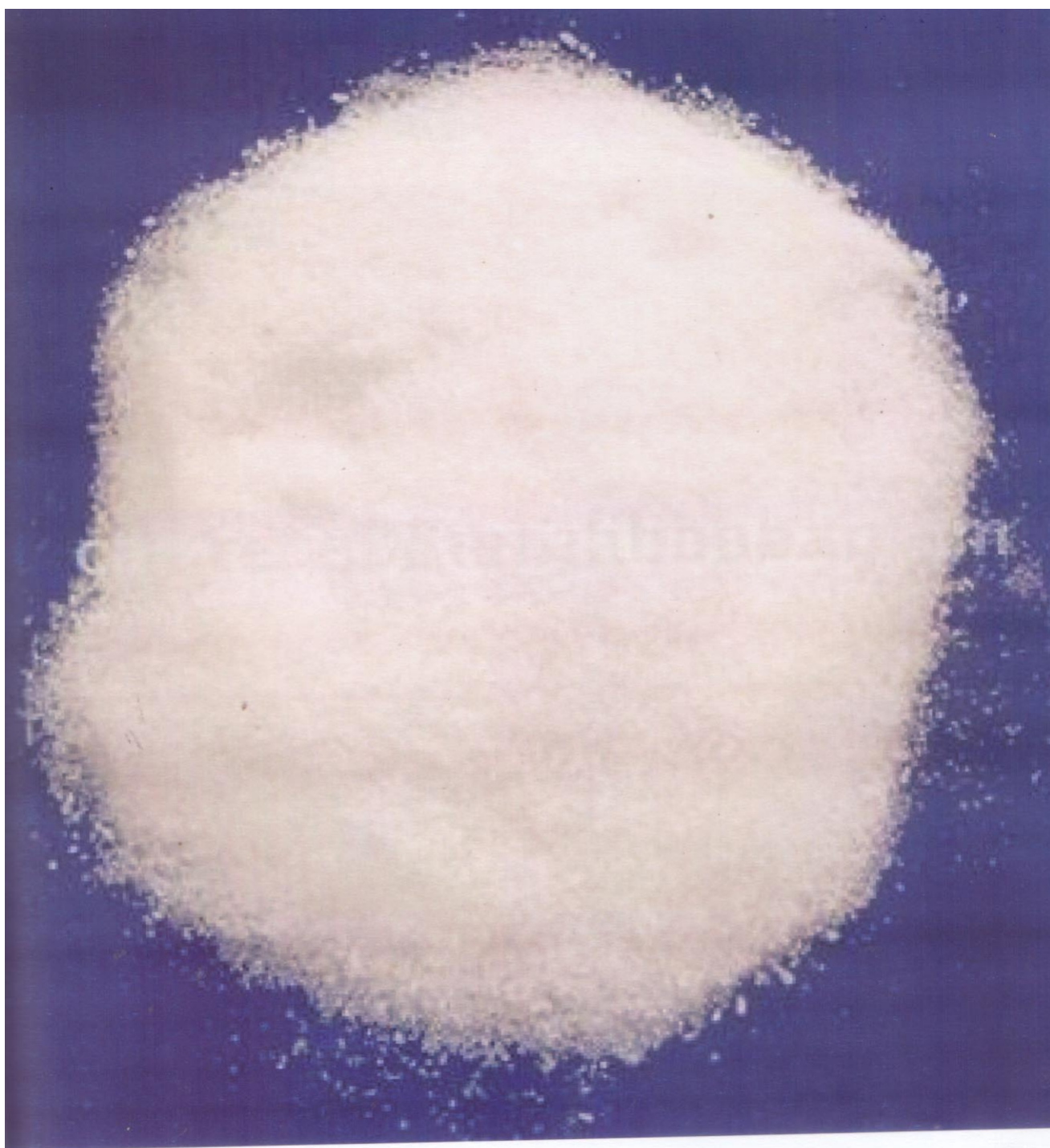
	Top	Bottom
1. Copper Boiler	3.	1.
1. Ditto	3.	1.
1. Copper Bottom	3.	1.
1. Ditto	3.	1.
1. Ditto	3.	1.
1. Ditto	2.	1.
4. Ditto	2.	1.
1. Ditto	3.	1.
1. Ditto	2.	1.

[illegible]

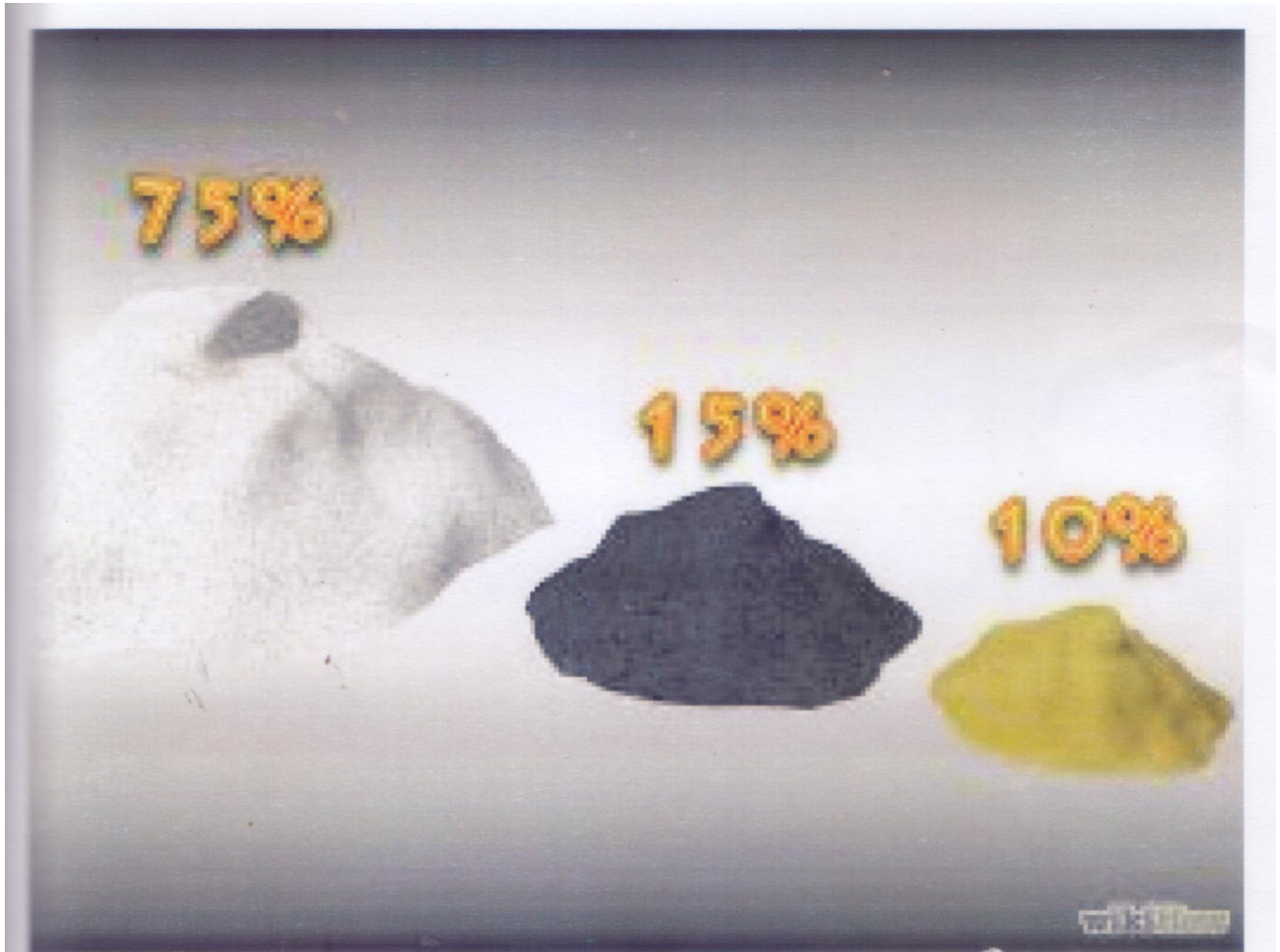
[Faint handwritten notes, possibly bleed-through from the reverse side.]

1894. 1895. 1896. 1897. 1898. 1899. 1900. 1901. 1902. 1903. 1904. 1905. 1906. 1907. 1908. 1909. 1910. 1911. 1912. 1913. 1914. 1915. 1916. 1917. 1918. 1919. 1920. 1921. 1922. 1923. 1924. 1925. 1926. 1927. 1928. 1929. 1930. 1931. 1932. 1933. 1934. 1935. 1936. 1937. 1938. 1939. 1940. 1941. 1942. 1943. 1944. 1945. 1946. 1947. 1948. 1949. 1950. 1951. 1952. 1953. 1954. 1955. 1956. 1957. 1958. 1959. 1960. 1961. 1962. 1963. 1964. 1965. 1966. 1967. 1968. 1969. 1970. 1971. 1972. 1973. 1974. 1975. 1976. 1977. 1978. 1979. 1980. 1981. 1982. 1983. 1984. 1985. 1986. 1987. 1988. 1989. 1990. 1991. 1992. 1993. 1994. 1995. 1996. 1997. 1998. 1999. 2000. 2001. 2002. 2003. 2004. 2005. 2006. 2007. 2008. 2009. 2010. 2011. 2012. 2013. 2014. 2015. 2016. 2017. 2018. 2019. 2020. 2021. 2022. 2023. 2024. 2025. 2026. 2027. 2028. 2029. 2030. 2031. 2032. 2033. 2034. 2035. 2036. 2037. 2038. 2039. 2040. 2041. 2042. 2043. 2044. 2045. 2046. 2047. 2048. 2049. 2050. 2051. 2052. 2053. 2054. 2055. 2056. 2057. 2058. 2059. 2060. 2061. 2062. 2063. 2064. 2065. 2066. 2067. 2068. 2069. 2070. 2071. 2072. 2073. 2074. 2075. 2076. 2077. 2078. 2079. 2080. 2081. 2082. 2083. 2084. 2085. 2086. 2087. 2088. 2089. 2090. 2091. 2092. 2093. 2094. 2095. 2096. 2097. 2098. 2099. 2100. 2101. 2102. 2103. 2104. 2105. 2106. 2107. 2108. 2109. 2110. 2111. 2112. 2113. 2114. 2115. 2116. 2117. 2118. 2119. 2120. 2121. 2122. 2123. 2124. 2125. 2126. 2127. 2128. 2129. 2130. 2131. 2132. 2133. 2134. 2135. 2136. 2137. 2138. 2139. 2140. 2141. 2142. 2143. 2144. 2145. 2146. 2147. 2148. 2149. 2150. 2151. 2152. 2153. 2154. 2155. 2156. 2157. 2158. 2159. 2160. 2161. 2162. 2163. 2164. 2165. 2166. 2167. 2168. 2169. 2170. 2171. 2172. 2173. 2174. 2175. 2176. 2177. 2178. 2179. 2180. 2181. 2182. 2183. 2184. 2185. 2186. 2187. 2188. 2189. 2190. 2191. 2192. 2193. 2194. 2195. 2196. 2197. 2198. 2199. 2200. 2201. 2202. 2203. 2204. 2205. 2206. 2207. 2208. 2209. 2210. 2211. 2212. 2213. 2214. 2215. 2216. 2217. 2218. 2219. 2220. 2221. 2222. 2223. 2224. 2225. 2226. 2227. 2228. 2229. 2230. 2231. 2232. 2233. 2234. 2235. 2236. 2237. 2238. 2239. 2240. 2241. 2242. 2243. 2244. 2245. 2246. 2247. 2248. 2249. 2250. 2251. 2252. 2253. 2254. 2255. 2256. 2257. 2258. 2259. 2260. 2261. 2262. 2263. 2264. 2265. 2266. 2267. 2268. 2269. 2270. 2271. 2272. 2273. 2274. 2275. 2276. 2277. 2278. 2279. 2280. 2281. 2282. 2283. 2284. 2285. 2286. 2287. 2288. 2289. 2290. 2291. 2292. 2293. 2294. 2295. 2296. 2297. 2298. 2299. 2300. 2301. 2302. 2303. 2304. 2305. 2306. 2307. 2308. 2309. 2310. 2311. 2312. 2313. 2314. 2315. 2316. 2317. 2318. 2319. 2320. 2321. 2322. 2323. 2324. 2325. 2326. 2327. 2328. 2329. 2330. 2331. 2332. 2333. 2334. 2335. 2336. 2337. 2338. 2339. 2340. 2341. 2342. 2343. 2344. 2345. 2346. 2347. 2348. 2349. 2350. 2351. 2352. 2353. 2354. 2355. 2356. 2357. 2358. 2359. 2360. 2361. 2362. 2363. 2364. 2365. 2366. 2367. 2368. 2369. 2370. 2371. 2372. 2373. 2374. 2375. 2376. 2377. 2378. 2379. 2380. 2381. 2382. 2383. 2384. 2385. 2386. 2387. 2388. 2389. 2390. 2391. 2392. 2393. 2394. 2395. 2396. 2397. 2398. 2399. 2400. 2401. 2402. 2403. 2404. 2405. 2406. 2407. 2408. 2409. 2410. 2411. 2412. 2413. 2414. 2415. 2416. 2417. 2418. 2419. 2420. 2421. 2422. 2423. 2424. 2425. 2426. 2427. 2428. 2429. 2430. 2431. 2432. 2433. 2434. 2435. 2436. 2437. 2438. 2439. 2440. 2441. 2442. 2443. 2444. 2445. 2446. 2447. 2448. 2449. 2450. 2451. 2452. 2453. 2454. 2455. 2456. 2457. 2458. 2459. 2460. 2461. 2462. 2463. 2464. 2465. 2466. 2467. 2468. 2469. 2470. 2471. 2472. 2473. 2474. 2475. 2476. 2477. 2478. 2479. 2480. 2481. 2482. 2483. 2484. 2485. 2486. 2487. 2488. 2489. 2490. 2491. 2492. 2493. 2494. 2495. 2496. 2497. 2498. 2499. 2500. 2501. 2502. 2503. 2504. 2505. 2506. 2507. 2508. 2509. 2510. 2511. 2512. 2513. 2514. 2515. 2516. 2517. 2518. 2519. 2520. 2521. 2522. 2523. 2524. 2525. 2526. 2527. 2528. 2529. 2530. 2531. 2532. 2533. 2534. 2535. 2536. 2537. 2538. 2539. 2540. 2541. 2542. 2543. 2544. 2545. 2546. 2547. 2548. 2549. 2550. 2551. 2552. 2553. 2554. 2555. 2556. 2557. 2558. 2559. 2560. 2561. 2562. 2563. 2564. 2565. 2566. 2567. 2568. 2569. 2570. 2571. 2572. 2573. 2574. 2575.

BOARD OF TRADE (COMMERCIAL) PROCEEDINGS

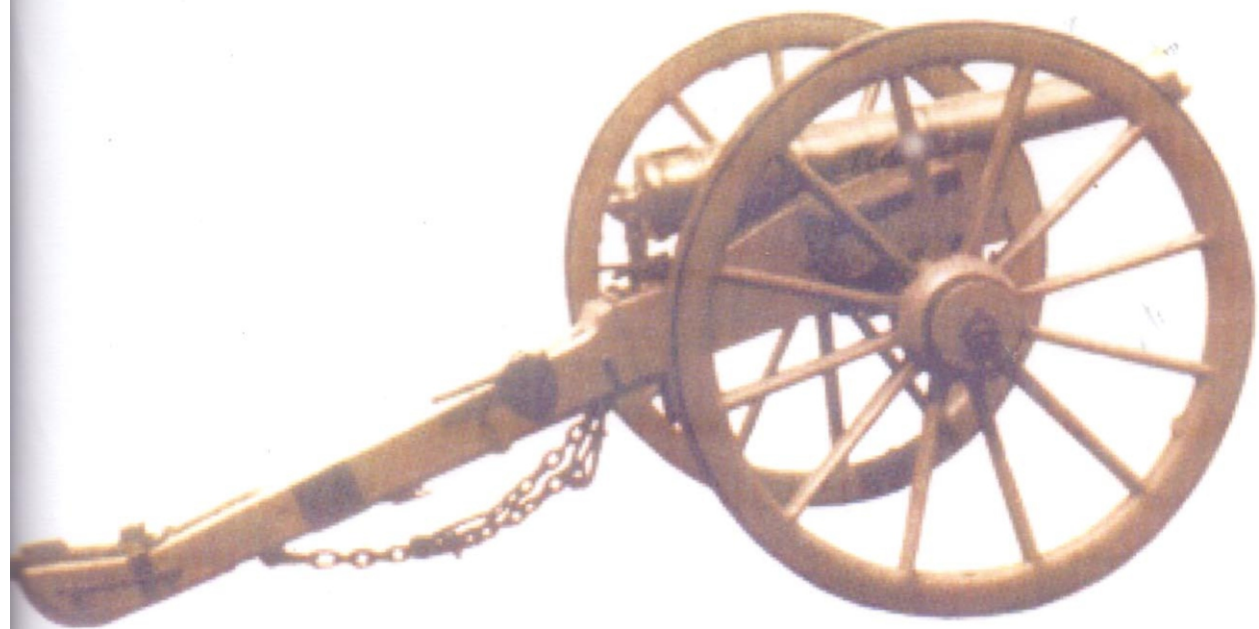


Saltpetre



75% potassium nitrate, 15% charcoal, 10% sulfur

Gunpowder



Waterloo 7 - 6-pounder gun



kettle used during civil war for processing Saltpetre



16THC woodcut showing Saltpetre distillation

4524
Sir William 4th Decr 1891.-

To L. Hook Esq.

Secretary to the Government.
Sir,

I have the honor to acknowledge the receipt of your Letter of the 17th Ultimo enclosing a letter from the Military Board to Government and desiring me to take such Measures as may be necessary for furnishing the information suggested in the 4th paragraph of that Letter.-

I request you will submit to the Honble the Vice President in Council that the Military Board will find as full information as it was in my power to give them on the Subject of the Comparative Quality of Patna and Rhanpore Saltpetre in a letter which I had the honor to address to their Secretary dated the 28th January 1893. in which I gave a Report of some experiments which had been made by the late Capt. Goding and myself for the purpose of ascertaining the point in Question.-

I think it the more necessary to refer the Military Board to that Report in as much as I observe that Mr. Farguhar in his Correspondence with them has led them into some Mistakes respecting it which had they been aware of, I am convinced they would

149 have

4525
Fort William 4th December 1801.

have thought a reference to Government on the Subject quite unnecessary. Mr. Targuhar, in order to account for the different result of the Experiments made by Captain Golding and me from what he had found in his own practice, States to the Military Board that the Salt petre which was the Subject of our trials was of a different sort from that which he had been obliged to employ. That which we used he informs them "was Rhanpore and the finest he had ever met with; that being dry, it, was not liable to a wastage of about three per Cent nor almost an equal one for Earth with which the Patna Salt petre is always mixed. yet" adds he "a comparison is made between the finest Rhanpore and Common Patna. Mr. Targuhar further alleges that Messrs Fleming & Golding weighed the produce of their experiments in the Crystals whereas it is weighed for Gun powder in the State of the finest Powder or Meal."

How erroneous all this is will appear at the very first glance on looking into our Report, a copy of which so far as respects Salt petre I have enclosed. It will there be found that our experiments were not confined to Rhanpore Salt petre but that they were made both on that and on Patna

Salt petre

4526

For William 11th December 1811.

Saltpetre and for the express purpose of determining the comparative loss on each in refining. It will also be found that the province of our Experiment was not weighed in the Crystals but in the state of the finest powder or Meal for the Composition of Gun Powder.

These two points, thus mistated by Mr. Farquhar are so essential to, and bear so directly upon the question between him and the Military Board, that as I have already observed had the Board instead of trusting to the Correctness of his quotations consulted the report itself, they would have deemed any further reference on the Subject unnecessary.

It is true that Mr. Farquhar mentions another circumstance which might occasion a difference between the results of his Experiments and ours; viz. a difference in the mode of refining the Saltpetre. He informs the Military Board that with a view of improving the Manufacture he had adopted the New mode of refining pursued by some of the able French Chemists one of whom was for many years at the head of the Government Powder Manufactory in France. From this account of his new mode I suppose he must mean that which is to be found in the 20 Vol. of the Annales de Chimie under the following title "Instruction

4529

Fort William 4th December 1807.

"Sur le Raffinage du Salpêtre nouvellement adopté par
les fabriques Nationales;" of this Mode I cannot speak
from Experience having never had an opportunity of try-
ing it neither is it in my power to comply with the
Military Boards request to have a small quantity
of Petna and Rhankon Salpêtre purified according to
it, for want of the apparatus which it necessarily
requires. I shall therefore only observe. -

~~1st~~ That as this Mode of refining Salpêtre,
for the Composition of Gunpowder was by advice of
the Committee of Public Safety dated 12 Vendémiaire
an. 3^{me} (1795) ordered to be followed in all the powder
Manufactories of the Republic, it seems extremely im-
probable that the process when duly conducted should
occasion a greater loss of Salpêtre than the mode
formerly in use. for considering the difficulty with
which Salpêtre is procured in France, this would
have been a powerful reason against adopting it.

2^d That Messrs. Berthol and Berthollet, the
Chemists who proposed this new Mode to the French
Government recommended it on the principal of saving
both labour and Salpêtre. After describing the Process
the chief improvement in which consists in fusing the
pure Nitre from the extraneous Salts by cold water
instead.

4528
Sir William 4th December 1801.

instead of boiling they declare as follows "Une apres lon-
gue experience nous a presente le procede que nous
venons de decouvrir comme le plus simple et le plus eco-
nomique".

Calcutta } I have the honor to be &c.
4th Nov. 1801. } Signed J. Fleming

Attest Copy

(Signed) L. Hook Secretary to
Government Mil. Dep^t

2 Saltpetre

To ascertain the Comparative loss on refining Bawnhor
and Patna Saltpetre we procured 10 pounds of Bawnhor
Saltpetre sent down from Ishapore by Mr. Sanguhar and
the same quantity of Chuprah Saltpetre from the Com-
pany's Ware House.

We found the loss on refining these
two pounds of Saltpetre so nearly equal that the
difference between them is not worth attention. In the
trial which we made with the quantity above men-
tioned it did not amount to more than 1 or 1/2 pound
in favour of the Bawnhor Saltpetre - Neither did there
seem to be any material difference in the quality of
the two Sals. We tried them by the usual tests of

153 Salt

4529
Fort William 4th December 1811.

Salt of Tartar and the nitrous Solution of Silver which shewed that they both were contaminated with Marine and Magnesian Salts but as far as we could judge nearly in the same proportions.

From the first boiling after scumming and Straining in the usual Manner we procured from 10 Pounds of Salt Petre 8 Pounds 11 ounces of crystals which re-dissolved and Evaporated to dryness afforded 7 Pounds 13 ounces of refined nitre in powder. Sufficiently pure we apprehend for the composition of Gunpowder at least it appeared by the usual tests to be fully equal in purity to the Saltpetre extracted from the Bengal and Madras powder which we had afterwards occasion to analyze.

From the liquor which remained after the first crystallization we procured on a second boiling 15 ounces of crystals which being redissolved and Evaporated to dryness produced $13\frac{1}{2}$ ounces of nitre in powder.

If this last nitre is taken into the account the loss on refining the ten pounds is at the rate of 13 pounds 7 ounces per Cent but should it be rejected and the nitre of the first Crystallization only be

received

4530
Fort William 11th December 1841.

Received the lps will amount to 22 per cent. we are of opinion however that the Crystals of the Second boiling are not sufficiently pure for the composition of Gunpowder and ought therefore to be rejected and applied to other purposes.

(A Copy)

Signed L. Hook Secretary
to Government M^{ty} Dept

To Mr General

Doctor Fleming in his report stating that it is not in his power to comply with the Military Board's request to have a small quantity of Patna & Baunthore Saltpetre purified, according to M^r Targuhar's new process, for want of apparatus; I conceive the Board must rest satisfied with M^r Targuhar's statements of lps by refining, - & as this has been the point upon which his Accounts have been delayed being recommended to be passed, I think they should now be recommended to the Honble the Vice President in Council to be passed, & the balance paid.

/Signed/ L. Dyer

Comd^g the Artillery

In consequence of my having received Dr. Fleming's Letter - I agree with the Quarter Master General /Signed/ C. G. G.

acting as President

The Board had better recommend to Government that M^r Targuhar be directed to purify the two Saltpetres,

4531

Fort William 4th December 1801.

in the presence of Doctors Fleming & Hunter, where those Gentlemen may point out, also that Doctor Fleming & Hunter be desired to select some situation, & the time for Mr. Farquhar to carry on the process of refining the Saltpetre according to the mode proposed by him. —

Signed W. Dpham

Resolution

The Board subscribe to the Vice President's proposition —

The following Letter from Capt. Mordaunt
To Captain Isaac Humphreys
Secretary to the Military Board

My Dear Sir,

I am directed by the Hon^{ble} the Vice President in Council to desire that you will furnish, for his information, with as little delay as possible, a detailed Statement of the expence incurred by the late Captain Mordaunt in keeping in repair the Ballinghoo, Allihoo, Boitacoonah & Midooroon roads for the last three years during which the roads were under the charge of that Officer.

The Statement is to distinguish general repairs from those which were only partial, and to exhibit the length & breadth of the road with the

quantity

1795
April 10th

3009.
Fort Williams

General in Council on the 5th Instant for 15,124 \$^d on account of Lieut. Mc Donald's Survey and Charts it is necessary however to observe, that by an Extract of a Letter from the Government at Fort Marlbo under date 5th April 1794, it appears that Sirign^{al} &c. Mc Donald has received an advance of 2,000 Dollars on account of this Business -

In the Letter which accompanied the Bill Lt. Mc Donald having expressed a wish that when passed the Money might be paid to Lt. Col. P. Murray I have therefore to request that after the Bill has undergone the Check of your Office, you will be pleased to order it to be transmitted to Lieut. Col. P. Murray -

I have the honor to be &c.

My B^d Office
the 10th April 1795

(Signed) A. Greene

1st Asst. my Board

To Mr. J. Farguhar -

Agent for the Manufacturing
Gun Powder

Sir

It appearing from the returns at the Close of the Manufacture last season, that the Quantity of Saltpetre then remaining in store at the Powder works was - 95. 20 -

and that the following Quantities has been Raised on Indents, between the commencement of the Manufacture, this Season, and the 2^d February last viz^t

Indent No. 795 - 3^d December 94 - 500. -

Indent No. 889 - 1st December 94 - 500. -

Indent No. 1111 - 22^d December 94 - 500. -

Indent No. 1118 - 12 January 95 - 1000. -

Indent No. 1178 - 2^d February 95 - 2000. -

Total 4595. 20. -

that

1795
April 10th

Fort William

3040

that by the Comptrolary of stores weekly return of Powder received into the Magazines up to the 27th ultimo the following quantities appear to have been delivered in by your Vert^y.

| | Barrels |
|--|---------|
| In November 1794 | 0 |
| December 1794 | 0 |
| January 1795 | 940 |
| February 1795 | 435 |
| From 1 st 6 th 27 th March 1795 | 1030 |

Total - 244 1/2 Barrels of M^{rs} lb

and that following a loss of 15 per Cent. by refining, and 6 per Cent by the water of Crystallization (if it is made very fine and only the Crystals of the 1st & 2nd waters are used) it will reduce the Quantity of 4875 M^{rs} Maunds to about 3630. If Maunds from which deduct 772 1/2 M^{rs} which at the rate of 75 lb for every 100 M^{rs} Barrels will be required to make the 244 1/2 Barrels of Powder received up to the 27th ultimo then should remain about 1200 M^{rs} of refined Salt-petre at the works on that day which is equal to the manufacture of nearly 1200 Barrels more, and there having been only 202 Barrels of Powder received from the Powder works between the 27th ultimo and 5th Instant, there ought still to remain near 1000 M^{rs} of refined Salt-petre, at the works, beside the 311 1/2 M^{rs} of unrefined allowed by you to have been received on Indent No 4390. Copied on the 30th ultimo, where as you state in the Column of Quantities remaining in the Indent No 4390 which was Copied and returned to you yesterday, that only 180 Maunds of every kind (vizt Rought, refined and in Solution) was then remaining in your Collection - I am therefore directed to call upon you to account for the deficiency without delay.

Mr B's Office
the 10th April 1795

I am Sir &c
(Signed) J. G. Humphreys
J. G. M. B's
Summons a Meeting for the 13th Inst

819
For William 13th June 1800

Brought forward ----- 338. 11. 7.
Workmen.

| | | | |
|-----|---|-------------------|----------------------|
| 15 | Bricklayers Mate | @ 8 V. p. Maund | 4 |
| 180 | Bricklayers | @ 5 V. p. 9 | 30 |
| 180 | Coolies | @ 3. 2. 2. p. 9 | 10. 13. .. |
| 25 | Grammis Mate | @ 7 R. p. 9 | 5. 13. 8. |
| 355 | Grammis | @ 4 R. p. 9 | 15. 5. 8. |
| 6 | Bhatts 100 Maunds each 2 Days for Conveying the | | |
| | above Materials from Balla Ghaur to | | 21 |
| | Tannah Post | @ 10 V. 8 a. p. 9 | 95. .. 4. 90. 14. 7. |

Total S. R. Four Hundred & twenty nine ten Annas & two Pie 429. 10. 2.

For William

B. M. Office

the 23rd May 1800.

/ Signed / H. F. Calcraft

Rarrack Master

P. A. the Party at Tannah Post Consists of 1 Havildar.
2 Naicks & 16 Sepoys.

Indents N. 2113. 11. 5. for Materials and
workmen for the same Corresponding with the Estimate

Resolution - - - - - Agreed to pass the Indents

25th April 1800

Circulation Paper A Meeting 25th April is
resubmitted Containing Proceedings on Mr Fargahar's Report
of the Bad Quality of the Salt Petre, Supplied for the
Manufacture together with the following Letter & Enclosure
from Captain Hook on the Subject.

To

Fort William 13th June 1800

To Captⁿ J. Humphrys

Secretary to the Military Board

Mily Dept Sir

I am directed by the Most Noble the Governor General in Council to transmit to you the enclosed Copy of a Report made by Mr. Fleming on the Salt-petre received with Captain Green's letter of the 15th of April last, and to desire that the Board will furnish Mr. Fargahar with an Extract of such Part of the report as they may think necessary, and direct him to State any Observations which he may have to make in reply for the Information of His Lordship in Council.

In Submitting Mr. Fargahar's reply, the Military Board are desired to give their Opinion whether the Complaints set forth in Mr. Fargahar's letter to you of the 19th of April last are well founded or otherwise—

The Salt-petre mentioned in Mr. Fleming's report is herewith transmitted—

Council Chamber

the 5th June 1800—

To Captain J. Hook

Sir—

I am Sir Yrs

Signed P. Hook

Secy to the Govt. Mily Dept—

Secretary to the Military Department

I beg leave to acquaint you for the information

Fort William 13th June 1800

of the Right Honble the Governor General, in Obedience that in
Obedience to his Lordships Command Signified to me in your
Letter of the 1st Instant. I have examined the Sample of Salt petre
transmitted to me with a view to ascertain how far it poss-
esses the Qualities which are considered as Essential in producing
"good Gun Powder."

As there is no Salt petre to be met with
absolutely pure, even the finest sorts containing a minute
proportion of Marine Salt from which it is impossible to free
them entirely it was necessary to have some Standard by which
the Comparative purity of the Salt petre in Question might be
estimated. For that purpose I extracted the Salt petre from
some Battle Shooting powder which is reckoned the best
powder that is Manufactured in England & therefore may be
supposed to contain in its Composition Salt petre of the first
Quality with this Battle Salt petre I compared the Sample
sent me for examination after I had purified it in the usual
manner by Solution, boiling and Crystallization. Having subjected
both sorts to various trials I found them as nearly as possible of the same
quality Even the Nitrous solution of Silver which is con-
sidered as the Richest test discovered no perceptible
difference in their degree of purity. I therefore conclude
that

822

Fort William 13th June 1800

that the Saltpetre, from which the Sample sent me was taken does possess the qualities which are Considered as essential in producing good Gun powder.

Having learnt that the Sample transmitted to me for examination was Batna Saltpetre I took this opportunity of Comparing it with the Saltpetre Manufactured in the province of Oude. For that purpose I procured a small parcel of the latter from the Export-Mare House which I refined in the same manner and afterwards subjected to the same tests as I had done the Batna. The Result was by no means so favorable to the Oude Saltpetre as from the General opinion on this Subject I had reason to expect. The Behar Oude Saltpetre has a much larger quantity of earth mixed with it than the Oude and therefore the loss of weight in refining it is proportionably greater. But in regard to the essential point the proportion of Marine Magnesium and Calcareous Salts contained in each to get rid of which is the Chief object in the refining process the difference between the two Sorts is very inconsiderable. The fourth boiling if the operations have been carefully conducted brings them nearly to the same degree of purity & as far as Jean Jaques Lavoisier holds them both sufficiently fine for the Composition of good Gun Powder.

823

1.

Fort William 13th Jun 1800

I have the honor to transmit to you
herewith for the Inspection of his Lordship and the Military
Board Samples of the three different kinds of Saltpetre
which were the Subjects of the above Mentioned experiments
1. N. 1 The Saltpetre extracted from Battal Shooting
powder N. 2 Refined Behar Saltpetre - N. 3 refined
Cuba Saltpetre.

Export Ware House
30th May 1800

Saml. Sir. Esq.
Signed J. Fleming
Inspector of Drugs

L. A. Trus. Esq.

Signed L. Hark

Sent to the Govt. Secy Dept.

N. B. The specimens of Saltpetre referred to in Mr. Hennings
Letter are enclosed.

Recd. 10th May 1800

On the 9th ultimo, the Secretary was directed
to apply to the Military Paymaster General for the
Account N. 1544 in which the Saltpetre (3000 lbs.)
was supplied to Mr. Targuham.

The Secretary resubmits Extracts of the
Minutes Proceedings of 16th 17th 18th ultimo on this subject.

Mr. General

Mr. Targuham Should be furnished
with

324
Fort William 13th June 1800

with the 2nd & 3rd paragraphs of M^r. Flemings Letter & called upon to state any observations which he may have to make in reply.

[Signed] S. Dyer

Call on M^r. Farquhar also to state the proportions of Saltpetre, Sulphur, and Charcoal, used in the Manufacturing, also the Sort of Charcoal, used from the Year 96 inclusive.

[Signed] W. H. Cameron

Agree to M^r. Farquhar being called upon for the purposes, as above expressed by the Quarter Master & General, & Chief Engineer.

[Signed] C. Green.

Agree to furnish M^r. Farquhar with Extracts of M^r. Flemings Letter, & to call upon him to state what he may wish to observe in support of his former opinions also to call upon him for the information required by the Chief Engineer.

The Indent Should be returned to the Military Pay Master General.

[Signed] G. A. Robinson.

Agreed to transmit to M^r. Farquhar Copies of the 2nd & 3rd Paragraphs of M^r. Flemings Letter & that he be called upon to state what he may wish to observe in support of his former opinions.

243 Agreed

825
Fort William 13th June 1800

Agreed also that M^r. Ingham
be desired to State for the Board's Information, the
proportions of Saltpetre Sulphur, and Charcoal as well
as the Sort of Charcoal, used in the Manufacture from
the Year 1796 inclusive.

Ordered that the Indent N^o. 1547
be returned to the Military Pay Master General's Office.

/ The Board Adjourned /

W. N. Cameron. Chief Engineer
C. Green. Coll. Comd^g the Artillery

(19)

244

5179.

Fort William 22. January 1802

Received from the Secretary to the Board's Proceedings of the 20th Ultimo, an Action and Account received from Captain Barker, Superintendent of the new Powder works at Allahabad with the following letter which has been received in consequence from that officer.

Captain A. Greene,

Secretary to the Military Board.

Sir,

I have the honor to acknowledge the receipt of your Letter of the 20th Ultimo. -

I am sorry it will not be in my power to comply with the orders of the Board "to refine and report the produce of the 315 $\frac{1}{4}$ M.^{ds} of impure Sulphur" Separately, because the packages being broken, it was much mixed with the good Sulphur when received into the godown, and a great part has been purified together with the purer kind. -

The Process observed in Refining saltpetre at these works is as follows. - The rough saltpetre being beat fine with Mallets, is put into tubs, with 20 per cent of its weight of cold water, and there left to digest for twelve hours. - at which time the water is drawn off, and Ten per cent more of fresh water is added, which

1810 5180
Fort William 22. January 1802

in four hours is likewise drawn off and a third quantity $\frac{1}{3}$ per cent of fresh water is poured on the salt petre and drawn off in one hour after this operation about 80 M.^{rs} of salt petre is put into the boiler with 50 M.^{rs} of water, to which when boiling, a Solution of Vegetable Alkali is added to precipitate the foreign salts - when sufficiently boiled, the solution is ladled into large Tubs, where it deposits all earthy matters - and thence drawn off into the Copper pans to crystalize - The crystals are reboiled in the same manner a second, or a third, and sometimes even a fourth time before the salt petre appears to be pure enough for the manufacture - From the water of the boiling pans more salt petre is extracted by evaporation, and purified to the proper degree by repeated boilings as above mentioned, till the whole of the salt petre is extracted and no Residuum remains but Earth and foreign Salts - The Loss in purifying on the salt petre I have hitherto used has been about $\frac{1}{10}$ per cent but it is far from being of the best kind. Containing an unexpected quantity of common salt It is procured from Coil and the Turruickabad district, and the Board will be pleased to observe that the price for it is but 3. 4. ^{Rs. as} per cwt. whereas

I am

133

581

Fort William 22 January 1802

I can procure none produced in the Nabob's territories (which is all subject to a Monopoly) for less than from $\frac{1}{4}$ R. to $\frac{1}{4}$ R. 12 d. p. c. M. which high price has hitherto prevented my using it. To the above loss is to be added about 3 or 4 per cent produced in drying at the grinding house, and from 5 to 8 per cent wastage in the different stages of the Manufacture the quantity of Firewood used in purifying 100 M. of Salt petre of this kind, including the repeated boiling and evaporating of the water of the cooling pans, is about 200 M. as the firewood is used in the Sulphur Refinery, and by the Brass smiths &c. I am not able to state the exact quantity, and to make a direct experiment at present would be a tedious interruption to the regular Course of the Refinery. -

From two Experiments made to ascertain the quantity of good Charcoal produced from 100 M. of Urhur doll bush, I conclude that the quantity of wood fit to be stacked for burning is 70 M. in each 100 M. of Bush - and that this 70 M. produces about seven M. of good Charcoal, after making allowance for such portion as is rejected by the pickers at the grinding house. It is obvious that much must depend on the quantity of moisture in the fresh bush, as well as on the quantity of branches too small to be converted into good coal. -

conformably

5182 -

Fort William 22nd January 1802. -

Conformably to the orders contained in your letter, I shall
in future apply for surveys on all powder barrels made at
these works; some have already been issued without survey. -

I have the honor to be, &c.

Allahabad

January 9th 1802

/ Signed / J. Taylor,

Supt. new Post Works

Read - / Signed / W. Popham,

Captain Taylor is wrong in his Economy respecting
the Purchase of Coal, & Surruahabad Salt petre; should he require more
than he has already purchased for the powder of this season, direct him to
take measures for obtaining the best Cannon powder salt petre - / J. S. Dyer. -

Agreed to acquaint Captain Taylor accordingly. -

/ The Board Adjourned /

Cd. W. L.

/ Signed / W. Popham Major General Vice
President -

" C. Green - Col^l Com^d the artillery

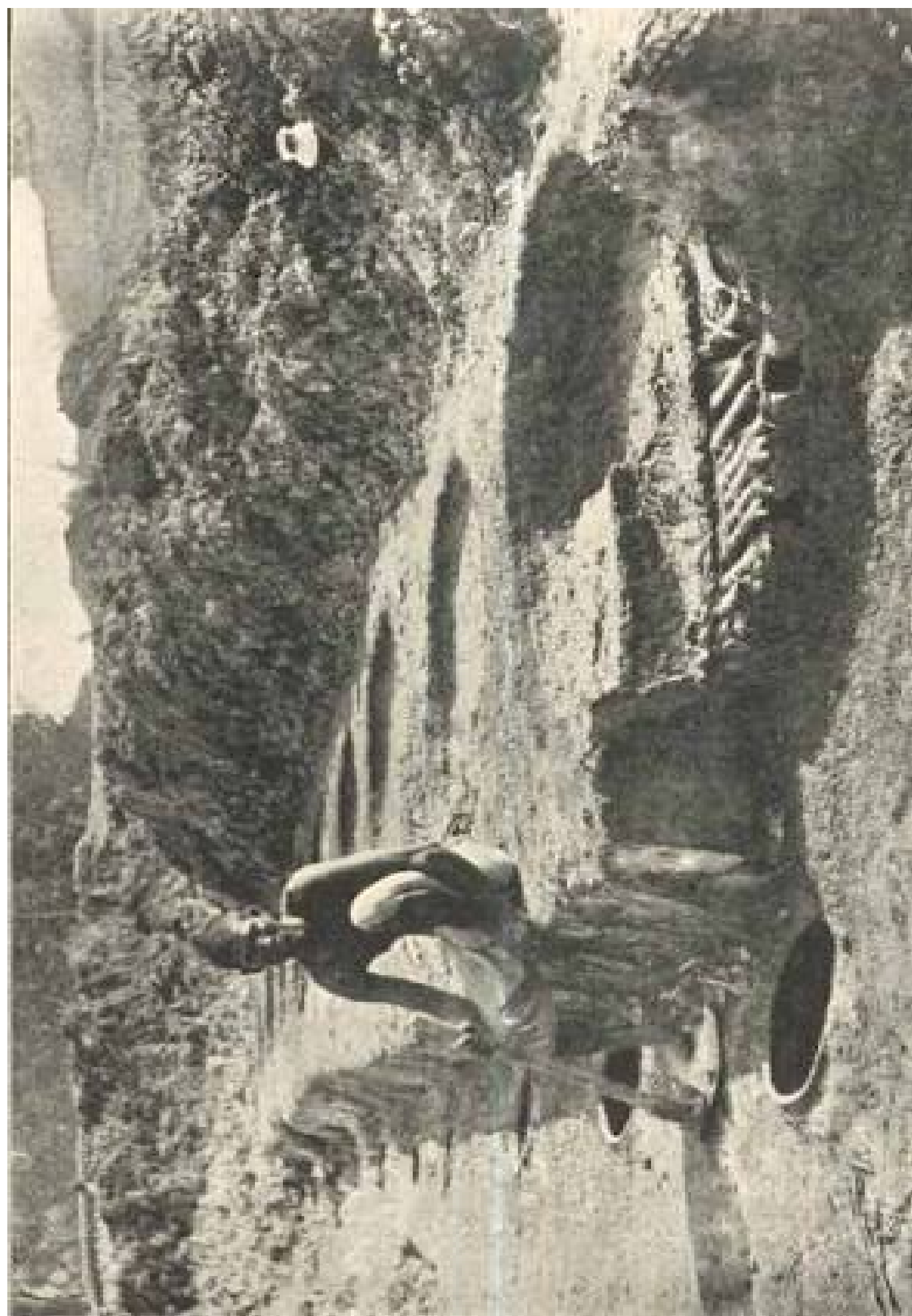
435

a)



b)











The above is a map of India from the 1800s, showing various kingdoms. The areas circled in red are some of the regions that were engaged in commercial production of saltpeter and the areas circled in green are the main areas from where it was exported to the world.