

## Long-Term Baysalt History Structural Changes in Salt Winning and Production in Western Europe

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Between Thirteenth and Seventeenth centuries, on the French Atlantic coasts between Southern Brittany and the Gironde estuary, sea farmers cultivated thousands of small-size saltfields. Thanks to the rivers, they were able to supply the entire Atlantic front of the kingdom of France, that is to say no less than  $\frac{3}{4}$  of the country with their salt crops. The saltfields were also visited every year by hundreds of ships that sailed from the Baltic sea ports or from Holland to fetch the precious salt. Breton ships would also carry it to Ireland, southern England, Flanders or Zeeland. The sunny French coasts provided the whole of Northern Europe with salt to cater for the needs of food processing, fishing, preserve making and a few odd industrial uses.

Whenever bad weather thwarted the gatherings, these sailors from the North would sail on to the saltfields of Portugal from whence they carried home a similar, rather greyish sort of salt (baysalt). Still other factors might deter the sailors from calling at French or Spanish ports, such as heavier taxes or an embargo ordered for political or religious reasons which excluded Protestants or Catholics. The kings of France or Spain made no bones about using the blockade weapon against their enemies. Giving accurate figures is not possible, but an estimate of 300,000 tons sounds reasonable,  $\frac{1}{2}$  of which went for the home market and the rest for exportation to remote parts of the world.

Until the late Sixteenth century, Northern Europe had produced salt in Lüneburg, in Holland, Scotland, either from shafts (Lüneburg, Droitwich) or from evaporating sea-water or again they used refined salt from abroad to meet the local needs (fishing salt). This white salt obtained through burning wood was expensive and hardly competitive with baysalt got through cheap solar energy, in spite of the very high freight costs for this product from afar. In the late Sixteenth century, Scotland discovered very rich layers of coal and set out first to refine the salt from the Bay to make white salt but then chose to boil seawater directly. The Firth of Forth and then the Tyne estuary quickly started exporting salt to Northern Europe, but the main discovery occurred under the three brine wells of Cheshire, at Nantwich, Middlewich and Northwich (the three wiches) where they reached two beds of rocksalt; they were first dissolved by injection of fresh water, then pumped out and boiled in big-size iron pans heated with the coal of nearby Lancashire. The rivers were canalized to enable exchanges between coal and rocksalt or white salt, a trade that benefited the port of Liverpool which shipped the salt to Northern Europe (Prussia), Ireland and Northern America. The trade kept growing to the point that, in the Nineteenth century, at a time when the French Atlantic coast no longer managed to clear 60,000 t of salt, the 2 salt-producing sites of Cheshire (Northwich and Winsford) were together despatching 414,000 t of white salt in 1840, 607,000 t in 1850, 696,000 in 1860 and 900,000 in 1870. The boiling salines inland were gradually adapting to mechanisation and the use of steam; in France they benefited from the building of the railway network, the updating of canals in the East, and from an advantageous price policy. In the West, the saltmarshes remained dependant on the climate and on an age-old tradition deeply ingrained in a landscape in which none of the latest innovations could possibly be introduced. The salt industry and its plants had got the better of the agricultural techniques of the saltmarsh, wage-earners and joint-stock companies had superseded the landowner and his tenant farmers.

### Introduction

Throughout Europe, several factors weighed heavily on salt winning production costs. These included the parcelling out of property and of salt winning activities which were split up among innumerable micro-firms, the feudal organization of production, and the multiplication of perpetual loans, which had long been the privileged means of finding capital for

investments. These various factors were leading to a crisis felt in the old salines of Lüneburg, Halle, Salins, or Droitwich. Salines in these towns experienced deep transformations, to the detriment of the old feudal *Salzjunker* families and of the Benedictine monasteries whose properties were secularised at the time of the Lutheran reform. In the Eighteenth century, under the influence of

mercantilism and of enlightened despotism, the State, in order to increase its fiscal revenues, did not hesitate to establish a monopoly on the old salines so as to carry out modernisation through the building of vast plants. That effort was furthered by technical and scientific progress, which allowed the selection of waters with a higher level of salt; these waters were concentrated further by running them through graduation houses where evaporation by atmospheric agents accelerated brine concentration. Mineral prospection for new and deeper salt springs in Westphalia as well as in England led to the discovery of coal. From then on, raw material and fuel were both available in the same place, and countries like Scotland and Northumberland, which until then had been deprived of salt production, but had confidence in their coal resources, adopted production directly from seawater. These coal-powered salt-boiling houses created the new black industrial landscapes with high chimneys which were characteristic of the first industrial revolution. In the Nineteenth century, open pan salt was reaching the top and the volume of its production exceeded that of sea solar salt in Europe. The development of the railway in the same time period played a fundamental role in freeing salt production from its ancient dependence on the sea. It ended the isolation of continental salines whose role had until then been negligible, by widening their market, as was the case in Lorraine. The construction of an extensive market constituted an important factor in the growth of production.<sup>1</sup>

### 1. Salt production in Northern Europe in the end of the Middle Ages

The time period was characterised by a great shortage of transportation, and these costs remained high, constituting the major part of the price of heavy goods, salt in particular. This was before the commercial and maritime revolution of the Twelfth and Thirteenth centuries, which witnessed the creation of new instruments, the progress of harnessing on roadways, as well as nautical progress on seaways. The cost of transport raised a real protectionist barrier that divided up Europe into a multiplicity of economic cells protected from competition. In these conditions, whatever its economic cost, salt winning was conducted in situations of *de facto* monopolies. All salt springs, even those with low concentrations, were equipped to produce salt for narrow local markets. This was the time when local needs were met through self-sufficiency, in a mediocre autarky, and when the exchange economy was in decline.

#### 1.1. The growth of solar saltworks on the Atlantic coast

A few more important salines managed to reach the level of regional exchanges thanks to the proximity of rivers. Around the year One Thousand, one region had already started to develop a more important saline activity. It benefited from two favourable elements: summer sunshine and the proximity of the great French western rivers by which salt was sent inland. That region was located between the Loire and the Gironde and also included an area to the north of the Loire River. In the centre lay the Bay of Bourgneuf with the islands of Boin and Noirmoutier, in the south Brouage, the low Seudre valley and the islands of Ré and Oléron, and finally to the north the vast lagoon between Guérande and Le Croisic. Soils were favourable, tides flowed far inland through channels and the solar saltworks were the northernmost in Europe. Beyond, from the northern coasts of Brittany and onwards, water had to be heated with a fuel in order to produce salt. The solar saltworks, that bordered with populated areas deprived of salt springs and easily accessible by rivers, already counted thousands of small crystallisation ponds around the year 1000. They went through a slow but decisive development during the Eleventh and Twelfth centuries. In the Thirteenth century, a new environment for salt trading in the Bay was created due to demographic growth, the expansion of cities, the creation of new foods and the development of sea fishing in the northern seas, conservation of food by the means of salting, and the consequences of the nautical revolution which invented safer new ships with increased loading capacities. The French western saltworks were visited by ships from Hamburg by the end of the Thirteenth century. In the Fourteenth century, English or Hanseatic ships sailed down the French coasts every year to load up salt and wines before going back north. Each of the salt regions expanded through the creation of new salines to meet the increasing demand. A real development fever can be observed through the documentation, for example in the Guérande area from about 1350. But it would seem that supply was irregular: crops were subjected to changing weather conditions and submitted to political or military troubles, with the area being one of the main stakes of the protracted French and English conflict. The coasts of Aquitaine were an English stronghold, and thus the fleets often happened to lack freight and left with ballast, or chose to sail further down south to procure the precious salt. It also seems that these different areas attracted foreign vessels in turn.

The first to do so may have been the Bay of Bourgneuf, but in the Fifteenth century it had likely yielded its place to the Brouage-Oléron area, whereas in the Seventeenth century Guérande would seem to have succeeded in appropriating an important flow of exports – all this while the southward shift was carrying on, toward Setubal (Portugal) or Cadiz (Spain), where bad summer weather was almost unknown.

It is impossible to advance the slightest figure on the amount of salt traded in the Bay. It was considerable, which was why, in an extensive economy with low yields, the marshes converted into salines had to be stretched out of proportions, to reach the ultimate extent of the tide. A lot of time and money were then lost in conveying salt from the distant saltworks to the loading ports. Supplying three quarters of the Kingdom of France, as well as Northern Europe, in a situation of quasi monopoly from Great Britain to the eastern shores of the Baltic Sea, implied a considerable production. When the committee of inquiry presided by Deputy Favreau finally gave the first statistics in 1849-50, a yearly average yield of 250,000 tons<sup>2</sup> was indicated for the western salt, but at that point the crisis had been rampant for at least half a century, and it was already an old fact that salines were being abandoned. Le Terme, the Deputy State Representative for Oléron, pointed out in his 1826 report that in his administrative area there were 8,872 ha of productive saltworks and 8,151 ha of abandoned saltworks.<sup>3</sup> In the Sixteenth and Seventeenth centuries, production and trade can be reckoned without exaggeration to more than 300,000 tons. In Guérande, north of the Loire river, where statistics appear to be reliable, ships from Brittany took away 6,500 big 'muids of Guérande' in fifteen months at the end of the Fourteenth century for delivery to the southern coasts of England or the Basque ports scattered around Bilbao. Guérande salt also reached Normandy ports on the Seine River, or, from Nantes and the warehouses of Chantenay, the Loire region. In the very early Sixteenth century, annual productions from 7 to 11,000 muids were common, that is around 20,000 modern tons. The modern period expansion would have led to an average production of 35 to 40,000 tons a year.<sup>4</sup>

### 1.2. War, fiscal pressure and creation of new routes

The kings of France, who had enormous fiscal needs and worries, had imposed a heavy tax on the salt sold in the domestic market. That extremely unpopular tax, known as the 'gabelle', resulted in maintaining consumption at a very low level. But the kings also knew that they could not demand the same fiscal revenues from exported salt. The salt sold to foreign

merchants for export afar or to the owners of fishing boats was tax-free; foreign ships would otherwise have been re-routed toward foreign southern salines and the kingdom, being incapable of selling its salt, would have grown poorer. Salt provided work and a living to a number of professions in the domestic market, such as sharecroppers, salaried porters, measurers, owners of fishing boats and their crews, employees of tax farmers, custom officers and smugglers who evaded taxation, and in the foreign market to owners of ships and their crews, to porters, measurers, etc. French salt from the Atlantic was attractive because travelling distances were shorter, and because foreign merchants adjusted prices to their liking in the presence of numerous miserable saliners in a rush to sell as soon as crops were gathered, and from whom the merchants bought tax-free salt. A trip to Cadiz tripled the length and the travelling time for a ship sailing from Zelandia who wouldn't have found a load of salt in Bourgneuf. As long as continental salines produced salt at a very high cost, due to the multiplicity of works, like the drawing of brine, the maintenance of the pits, the transportation of the brine, logging, buying and transportation of wood, heating up in small pans, and low productivity, the salt from the Bay had almost no competition and enjoyed a situation of undisputed monopoly. This situation was dangerous and was exploited without much insight by the King of France, who used salt as a weapon in the economic war, which opposed him regularly to Holland or England. In times of blockades, ships from the Northern countries deserted French producers, reached the Iberian Peninsula, ventured into the Atlantic until the Cape Verde Islands, or even further to the Caribbean.<sup>5</sup> The expansion of sea salt production and trade had been the consequence of the transport revolution that had started in Europe from the Twelfth century. Salt traffic constituted one of the most important freights of the Atlantic or Mediterranean navies. Salt was at the centre of the relations that bound together a mostly agricultural economy and sea transports that had not stopped improving and gaining productivity.

### 1.3. Salt trading in the Bay

Salt from Luneburg reached Lübeck through the Trave (*Travensalz*) and from there was distributed on the Baltic shores. From the end of the Fourteenth century, it met with competition from Atlantic salt from Western Europe, either Scottish, French, or Portuguese, which was sent through the Sund straight.<sup>6</sup> Hanseatic merchants referred to all of these indifferently as 'Bay salt'. Thanks to the salt, Dantzic soon reached the second position among the Baltic ports behind Lübeck. In the Sixteenth century, *Travensalz* only represented 20% of the sea salt sea trade in the Baltic. Luneburg salt suffered from high production costs because of the wood used to heat up



pans and of the multiplicity of feudal type annuities. Bay salts were confronted to transport costs increased by the instability of imports, to the settlement of prices, to conflicts between border states, and to piracy, as travelling in convoys offered mediocre protection. When, in June 1475, the Dutch fleet of the Bay (70 to 80 vessels) was captured by the French, the part of the *Travensalz* on the Dantzg market suddenly went back up from 13 to 46% (from 630 to 940 *Lasts*). As far as prices were concerned, the actual ratio between *Travensalz* and *Baiensalz* was set to 2 for 1.<sup>7</sup> In the Baltic ports, in order to make more money, there were attempts to substitute Bay salt for Luneburg salt by refining Bay salt to obtain *Siedesalz*, which was passed off as *Travensalz*. To complete the fraud, the salt was placed into barrels from Luneburg called *Travetonnen*. Each port had such refineries at its disposal, including Lübeck, even though it dominated Trave salt trade.

The first outlets for the salt imported through Dantzg were the port's Polish Hinterland through the Vistula, upriver until Thorn and the fortresses of the Teutonic Order in Prussia, and second Lithuania until Kovno and Vilna. Königsberg tried to get involved in these trade links thanks to a staple monopoly and custom duties levied on transit trade. In spite of the two *Pfahl-* und *Pfundgeld* taxes, Dantzg was a cheap port, where loading costs did not exceed 0,5 to 1,5% of the declared value of the goods. This was why a great part of the salt imported from overseas was unloaded at Dantzg, which could send it on towards Riga or the Swedish ports. The port of Dantzg played an important role of distribution in the whole of the Baltic Sea. Sailors from Dantzg even went North of Stockholm to propose their salt in exchange for Swedish agricultural products (in the Sixteenth century), and they also provided Finnish ports with salt. From 1490 to 1492, the *Pfahlkammerbücher* of Dantzg had made an inventory of 227 ships that had reached Riga, Königsberg, and even Lübeck with Bay salt only, and all other Baltic ports, such as Stettin, Rostock, Kopenhagen, Kalmar, Stockholm, Riga, Abo, Reval, etc, with both Bay salt and Trave salt. Together these expeditions represented 2,400 *Last* of salt (800 per year).

#### 1.4. The domination of salt trade by the Dutch

Bay salt import trade had first been entrusted to Hanseatic ships, particularly Prussian ones, but from the Fifteenth century, the Dutch and the Zealanders took a great part in it. Half way between the Iberian Peninsula and the Baltic Sea, the Escaut Delta became very important when Hanseatic ships sailed down the French coasts right from the end of the Thirteenth century to look for salt and wine, and then down to the Iberian ports in the Fourteenth

century. On the way in, these ships, which had come from the Baltic Sea, transported grain destined to the densely populated Netherlands, as well as materials useful to shipyards. But in the Netherlands ports, they only found insufficient textile loads and local metallurgic products as return freight, or imported wine and spices, that were expensive products with little commercial demand for a reduced Baltic population with low purchasing power. When these ships carried on further to the French ports, they found the same products there, which, as they were just as uninteresting for the Baltic market, were unloaded in the Netherlands. The solution for the freight back was found with the transport of salt toward the Baltic Sea, first Bay salt, then salt from the Brouage, and finally Portuguese and Spanish salt. Hanseatic ships that had unloaded their freight in the Netherlands, afterwards left on ballast for the French ports. Loaded with salt, they happened to enter the mouth of the Escaut River in order to abide by the Hanseatic rules on winter navigation, and to respect the long wintering waiting period between November 11 and January 22. Now navigation from Hanseatic ports often started after the wheat harvest and its transport to the ports. Unable to go back to the Baltic sea because of the winter navigation break, they could reach the French coasts to load up on wine, salt, iron, and spices destined to the Netherlands and England. In the springtime they returned to the French ports to take salt and go straight back to the Baltic Sea. The stopover of the Hanseatic ships in the mouth of the Escaut River was therefore a complex phenomenon. They came in to unload the Baltic Sea products or the products from Southwestern Europe, but their stay was mostly motivated by wintering. By the beginning of the Sixteenth century, Hanseatic ships took the salt in the Zealand ports, which had acquired a powerful refinery industry.<sup>8</sup> From the middle of the Fifteenth century, Breton and especially Dutch ships came to occupy more and more room in this traffic. They came to the harbour of Walcheren, in Zealand. The long route of Bay salt between the French Poitou and the Eastern Baltic Sea was then constituted of two segments, a first western segment until the mouth of the Escaut River and the Zealand ports controlled by Breton and Dutch navies, and a second eastern segment in the hands of the Dutch sailors and incidentally of the Hanseatic ones. In the middle, Zealand offered its services to refine and increase the value of Bay salt.

Since the late Middle Ages, Great Britain had also been getting  $\frac{3}{4}$  of its salt supplies in Atlantic salt from the Bay, Portugal, or Spain. In 1700, it continued to import sea salt, but had also started to export its common salt towards the Netherlands, Ireland, the West Indies, and its American colonies.<sup>9</sup>

## 2. The birth and the development of an industrial giant

In order to ensure a real autonomy in supplies and not to depend on the good will of foreign merchants or of a hostile monarch, it was necessary to produce salt at a cost at the best equal to the price of Bay salt brought to the Northern ports. It was urgent to find a solution, to meet the increasing needs of an expanding population and new needs, related to food or hygiene (soap for example). All of the Southern coasts likely to produce salt had been turned into salines. The relatively reduced cost of Bay salt was explained by the use of free energies, like the sun and the wind. It was necessary to discover energies cheaper than the wood with low heating power used in the continental pan-boiling salines. Easily mined English coal was going to offer an alternative solution. The development of pan-boiled salt would be the fruit of the industrial revolution based on the use of coal then steam.

### 2.1. The small production of the old medieval salines

In Great Britain, salt springs had been exploited since the Middle Ages in three Western counties, Cheshire, Staffordshire, and Worcestershire. The main production centres of Cheshire were three boroughs, Northwich, Middlewich, and Nantwich, and the most important, the oldest one that had been active since the Iron age was Droitwich (Worcestershire). In the salt boroughs, a *saltern* (or *wich house*) housed small-sized lead pans placed on furnaces. In Nantwich, the pan measured 3 1/2ft on 2 1/2ft for a depth of 6 inches. In this borough, the brine from the only pit was divided into 216 parts or *wallings* (boilings), with a boiling corresponding to the quantity of brine boiled in 24 hours in 6 pans of a capacity of 24 gallons each. Middlewich had 108 *wallings*, and Northwich, 118 *wallings*. The Earl of Huntington, in the account of his trip in 1636, described the works of the pit and of the brineworks.<sup>10</sup>

According to naturalist John Ray (1674), the property of the Nantwich pit was divided among a great number of persons who could either cook salt themselves, or sell their rights.<sup>11</sup>

« Saltwater taken out of the brine-pit in two hours and a quarter boiling, will be evaporated and boil'd up into salt. When the liquor is more than lukewarm, they take strong ale, bullocks' blood and whites of egg mixt together with brine (...). They do not evaporate *ad siccitatem*, but leave about a gallon of brine in the pan, lest the salt should burn and stick to the sides of the pan »<sup>12</sup>.

Damp salt was taken out of the pan, placed into wicker baskets of a conical shape called 'barrows' and put to dry between the furnace and the chimney. Everything therefore points to a small production of a home-made and empirical type, scattered around innumerable workshops huddling around the pit. They shared the brine, which was scarce, and employed numerous workers at the pit, in logging and transporting of wood, in the making, packaging, transport and commercialisation of the salt. The insufficient production did not cover the needs, and Great Britain imported 3/4 of its consumption from the Atlantic marshes of the Bay (in France), of Portugal, or Spain.

### 2.2. The use of coal and the energy revolution

From the Sixteenth century, firewood heating to obtain salt declined sharply, as the forests were being depleted. Around Shield (Northumberland) and the Firth of Forth in Scotland, the abundance of coal, a recently discovered cheap source of fuel, encouraged the creation of manufactures that evaporated seawater directly. A new group of saliners appeared then on the banks of the Firth of Forth in Prestonpans, Saltcoats, Grangepans, Kennetpans, and Saltpan Bay. Its production was reaching 318,000 bushels by around 1770.

The importance of Scottish salt was measured in Brême, whose imports came from Scotland (38%), Luneburg (20%), Spain (Puerto Santa Maria) and from Brouage. The arrival of Scottish salt had only started in 1587-90, at a time when all the little 'coal and salt towns' were thriving on the shores of the Firth of Forth. Scottish salt exports greatly benefited from the Thirty-Year War, from 1620 to 1640, when civil, religious, and military troubles paralysed all commercial activity on the continent. The main markets then were England, the United Provinces, and the countries around the Baltic Sea.<sup>13</sup> From 1657, Newcastle, imitating its Scottish neighbours, also exported its salt, with lead and coal. By the beginning of the Eighteenth century, Northeastern salt yielded its place to Cheshire salt. Exports fell to 253,000 bushels in 1787-88. By the end of the Eighteenth century, all coastal refineries had closed. In Shields 20 active pans out of 200 were left.

Coal opened the way to another innovation, namely the use of iron pans instead of lead pans. Pans that were twice as big were used. These iron pans had been used since the Fifteenth century on the Northeastern shores, but in Cheshire this did not happen until the second quarter of the Seventeenth century. Iron resisted better than lead to the more intense heat generated by coal. From 1550 to 1700, British salt production strongly expanded. In the 1660s, systematic prospecting for coal in central Cheshire led to the discovery of new beds of rock

salt in Marbury. This rock salt was still refined through the usual process of dissolution by fresh water and boiling in pans to obtain white salt.

On the Northeastern coast, 6 to 8 tons of coal were necessary to produce 1 ton of salt from seawater. In Cheshire around the year 1660, Nantwich produced 6 to 8 times more salt for a ton of coal than the northeastern companies.<sup>14</sup>

### 2.3. The growth of Liverpool as a salt port

In the years 1660-70, Liverpool, which until then had been a modest fishing port, rapidly became an active trade centre. New activities were developing: the refining of West Indian sugar and the tobacco trade. Liverpool was becoming a centre for the triangular trade based on the purchase of slaves in Africa, slave running, and importation of products from the West Indies. Slaves and sugar were at the origin of the development, but the rock salt from Cheshire mined from 1690 rapidly contributed to the growth. Salt was important for arms traders and for coastal trade with Ireland. From 1689 to 1713, the wars with France blocked imports coming from France or Spain. In 1700, England was still importing sea salts, but she had already started to export common salt from the East coast to the Netherlands, and from Cheshire to Ireland,<sup>15</sup> the West Indies and the North American colonies.<sup>16</sup> In 1706 a number of Danish vessels inaugurated international salt traffic in Liverpool when they docked to take on 1,250 tons of salt. In 1724, Defoe noted that the Liverpool merchants sent their vessels loaded with salt to "trade round the whole island, to Norway, to Hamburg, and to the Baltick, as also to Holland and Flanders."<sup>17</sup> Salt was an excellent return freight that was easy to sell for the vessels engaged in trade with the Baltic and with Northern Europe.

### 2.4. Transport and the lowering of production costs

Liverpool, which was well located in relation to the close Lancashire coal mines, enjoyed a considerable advantage: the cost of a ton of coal was 5s 6d, whereas it was three times as expensive when loaded for Northwich (16s 8d). It was first attempted to transport rock salt to the Dungeon refinery on the estuary of the Mersey.<sup>18</sup> Then, in order to lower the cost of the transport of the rock salt destined to the coastal refineries scattered on the coasts of England and Ireland, the Weaver was canalised between 1721 and 1733. From 1747 to 1777, the loads of rock salt going down the river quadrupled, and those of white salt doubled. In 1777, a total of 85,000 tons of salt were sent that way. In 1800, the loads of white salt reached 100,000 tons. In Northwich, under the impulsion of investors from London and of Liverpool merchants, the drilling of new salt pits

outside the city contributed to the expansion of the production.

In 1755, the Liverpool merchants had the *Sankey navigation Act* adopted. With the help of barges with sails, it established a link between the St Helens coal and the estuary of the Mersey, and from there the Weaver. The two promoters of the *Sankey Navigation Act* were, for one, owner of the Dungeon salt refinery, and for the other heir of the Liverpool one.<sup>19</sup> The barges never lacked return freight; they took white or rock salt in Cheshire for Liverpool and other ports on the Mersey, from there they reached St Helens through the Sankey and with the coal went back towards the Weaver. In the 1790s, excise inspectors noted the simultaneous presence of 83 barges unloading salt in Liverpool. Exports of St Helens coal, the main outlet for which was the Cheshire salt works, progressed at the same time: 85,000 tons in 1800, 100,000 tons in 1817.<sup>20</sup> In the Nineteenth century, salt contributed to the development of three industries in Liverpool: the chemical industry, soap and glass.<sup>21</sup>

### 2.5. Underground prospecting and the discovery of new deposits

Their situation of monopoly incited the coal owners to raise the prices in wartime, which drove salt boilers to dig their own pits to look for coal. Agreements started to be made between saltmakers and coal owners with thirty-year leases for the mining of new sites.<sup>22</sup> Saliners were becoming mine owners, before this trend was inverted with mine owners acquiring salines in Cheshire. The process was over by 1830. Thanks to underground prospecting, bottom rock salt of 12 feet thickness at a depth of 150 feet was discovered and mined in Cheshire from the years 1779-81; in the Lawton district top rock salt had been discovered in 1670 at a 100 feet under the surface. In 1780-81, this layer of salt was reached near Winsford at Marston Old Top Mine. The author of the discovery was Engineer John Gilbert (died in 1795), who owned part of the mine and put in a Boulton & Watt rotary steam engine to bring up rock salt or pump up brine. A third great change took place then with the introduction of the steam-pumping engine. By 1778, two saline owners in Lawton had set up a small Boulton & Watt steam engine that was capable of pumping 24,000 gallons in 12 hours up to a tank located 300 feet above pit level.<sup>23</sup>

An anonymous witness<sup>24</sup> described the mine and its large salt pillars supporting the ceiling, between 18 and 20 feet square. Eleven to twelve mines exploited in the area, produced 50 to 60,000 tons of rock salt, the major part of which was exported and transformed into white salt on the spot. 700 flats



were used on the Weaver for the transport of salt and coal. The salt country had become a country black with smoke, soot and dust. In the mine, explosives ripped out rock salt. Miners went down the mine at 6:30 to start work at 7:00, they worked in teams with brief intervals of rest until 3:00pm, and were paid per ton brought up from the pit and counted by the excise inspector.

From 1840, Winsford surpassed Northwich with regards to white salt expeditions on the Weaver, but Northwich retained the top spot for rock salt. The two saline centres together shipped 414,000 tons of white salt in 1840, 607,000 in 1850, 696,000 in 1860 and 900,000 tons in 1870. This success had been encouraged by the Chamber of Commerce for Salt, which was created in 1858 to find markets overseas for Winsford salt, especially in India.<sup>25</sup> After 1870, one million tons per year were regularly exported. Salt had become, after coal and iron, the third greatest English export product.

#### 2.6. Modest effects of the continental blockade

From 1803 to 1805, Cheshire salt exports were distributed in the following way: continental Europe: 45%; United States: 22%; rest of the world (that is the British Empire): 33%. In 1808, the salt industry suffered a serious depression (172,000 tons transported on the Weaver) because of the difficulties with the Baltic trade, and of the interruption of exports towards the United States, but there was a strong recovery thanks to an expansion of shipments towards these two foreign markets (256,000 tons transported on the Weaver). The index of the official value of exports went from 81 in 1808 to 116 in 1809 and to 119 in 1810. The 1811-12 depression and the closing of external markets seriously affected the salt (index of 73 in 1811, 97 in 1812). The port of Liverpool, which had exported more than 7 million bushels in 1810, shipped only 4 million in 1811. The loss of the American market was not compensated by the re-opening of the Northern European market in 1812. The price of salt in Cheshire had fallen from 7 or 8 d a bushel to 3 d a bushel. The coal and salt stocks were very heavy, and were sold at a loss, production was decreasing, workers were unemployed, and the industry was in a miserable state. There was a threat of war with the United States<sup>26</sup>. The Napoleonic blockade was however applied too irregularly to seriously hurt the British economy, which quickly recovered. In 1844 the West Indian market was opened to British salt, the growth of which was thus accelerated<sup>27</sup>.

Cheshire and Liverpool salt reinforced its primacy in the British Isles. In 1823, the abolition of the duties levied on salt, which had been demanded

by the users and the consumers, opened the way to Liverpool salt in Scotland itself. From then on, Liverpool salt reached Norway, Hamburg and Bremen, the Baltic Sea, Flanders, and Holland without competition. The trip from Liverpool through Northern Scotland lasted 14 days by fair wind, and twice as long in bad weather.

In the West of England, Droitwich no longer exploited its salt in the Nineteenth century<sup>28</sup>, and Nantwich stopped its activity in 1847. In the beginning of the Nineteenth century, toprock mining was abandoned and almost all of the mines were destroyed by the introduction of water or brine into the pits. Brine formed in the bottomrock. Pumping resulted in the sinking of the bottom of the mine, and in Winsford the level went down 20 yards from 1865 to 1880. 'It is evident that more brine is being pumped out than fresh water getting in to make new brine to replace it'<sup>29</sup>. Many pits dried up. A lot of mines dug in the lower and purer layer were transformed into reservoirs containing more than 50 million gallons of brine which were brought up through the pits. The industry used 4 million gallons daily to make white salt. The brine was pumped into the reservoirs by steam pumps and distributed to the pans through a network of pipes. Ward also noted that the Cheshire brineworks made different qualities of salt.

« the larger the crystal the less the heat and the longer the time required to make salt ; the smaller the crystal, the greater the heat, and the less time required to make the salt. Brine boils at 226° Fahrenheit, boiled salts are taken out of the pan two or three times in 24 hours, common salt for soaperies and chemical works every two days, fishery salt remains in the pan, according to the grain, from 6 to 14 days, bay salt three weeks to a month. The manufacturer, by manipulating his brine, can make the crystal more or less flaky or more or less solid as he wishes. (...) Bay salt is made at a temperature of about 90°, fishery from 90 to 140° according the grain, common salt 170° to 180° »<sup>30</sup>

Ward established a connection between the number of pans and white salt production:

	Pans	Production (tons of 1000 kg)
Winsford	638	1.000.000
Northwich	458	600.000
Middlewich	13	20.000
Sandbach	69	100.000

He gave the statistics for ten years ending on December 31<sup>st</sup> 1880 on Cheshire salt exports through the Mersey ports (in thousands of tons).

	White salt	Rock salt
United States	2118	
Canada - Newfoundland	691	
Africa	246	
India	2552	
Germany	345	
Russia	581	
Scandinavia, Iceland	197	
Belgium, Holland	81	644
England	1340	185
Ireland	469	64
Scotland	711	

During these years, annual production reached 1 ¾ million tons a year.

'In connection with the manufacture of salt is the extensive subsidence of land, and the great destruction of property caused by it'.<sup>31</sup> Ward calls into question not the mine, which put in pillars to hold the roof, but 'the brine streams, or brine runs', which brought together brooks and rivers coming from all sides. The flow of these underground rivers created a depression on the ground surface. The quickly dissolved salt dug caves, which were filled in by underground lakes (or flashes), and the land collapsed, provoking a general sinking of the surface. These caves, created by pumping, were abundant in the immediate vicinity of Winsford and Northwich. In each of these two districts, about 1000 acres of land showed signs of subsidence, and a total of around 3000 acres, as well as 1308 private or public buildings, were more or less seriously damaged, along with canals, railways, and water and gas distribution networks (report for the House of Commons, May 1883).

### Conclusion

However, transport based on the railway and the use of steam engines, one last element of the industrial revolution, was going to give the final deathblow to Atlantic salt. We saw earlier how much the improvement of the river transport network around Liverpool in the Eighteenth century had contributed to securing the prosperity of Liverpool and had enabled Cheshire to conquer the monopoly of salt production in the United Kingdom. In France, the transport revolution, a century later, was going to contribute to drastically change the production of salt and to pull up rock salt and the Lorraine brineworks to the top position in less than half a century. The construction of railways, a tariff policy advantageous to the salt from Lorraine, the investments accepted for the modernisation and the creation of new salines, the development of the chemical industry with the Leblanc and then Solvay

procedures for the making of soda, which created new and important outlets for salts and brines, the proximity of rock salt and coal deposits in Lorraine<sup>32</sup>, the impossibility of mechanisation through the introduction of steam engines in the Western marshes, the persistence of a very heavy taxation on salt, the arrival in Dunkerque of salt from Liverpool at a better cost than Western salt, all of these events signalled the decline of Atlantic salt and the disappearance of the salt marshes, which survived in Guérande with great difficulty, first thanks to a protected market for Brittany, and today thanks to a diversification of production, of markets, and also to an active promotion campaign.

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- <sup>11</sup> CHALONER, p. 63.
- <sup>12</sup> C. A. WHATLEY, *The Scottish Salt Industry, 1570-1850. An economic and social History*, Aberdeen U. P. 1987, 169 p.
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- <sup>16</sup> BARKER, p. 87.
- <sup>17</sup> BARKER, p. 87.
- <sup>18</sup> BARKER, p. 93-4 : "The Sankey Canal was a salt makers' creation".
- <sup>19</sup> BARKER, p. 95.
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- <sup>29</sup> WARD, p. 15.
- <sup>30</sup> WARD, p. 16.
- <sup>31</sup> WARD, p. 22-4. See the photographic file put together by Calvert, op cit.
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