

**XV.—Remarks on the Salt Mines of Wielitska
in Poland, and of Salzburg in Germany.**

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Communicated in a letter to JOHN AYRTON PARIS, M.D. &c.

IN my last communication I gave you some account of the arsenic and cobalt works of Saxony and Bohemia; I now send you an extract from my journal, containing remarks on the celebrated salt mines of Wielitska in Poland, which I visited in the summer of 1815, and also on those of Salzburg, which I had seen in the preceding fall, in passing from Vienna into Italy, through the Tyrol.

On Friday, the 30th of June, I called upon Mr. De Lille, the director of the Wielitska mines, by appointment, having been favoured with a letter of introduction to him by Mr. De Draverujak, the President of the Board of Mines at Schemnitz, in Upper Hungary. I

was received with the greatest civility, and his son was so obliging as to accompany me in my under-ground excursion.

Salt mines are a sight, in the description of which, travellers are generally found to indulge their fancies. I have not myself met with any account of those of Wielitska, but I understand that some flowery descriptions of them have been published, and I must admit, there are few cases in which they would be more excusable.

These mines are situated at the foot of the Carpathian mountains, on the north side, and about eight miles from the city of Cracow. It is proved, from authentic documents, that they have been worked upwards of 600 years.

The mouth of the principal shaft is in the town of Wielitska, and the workings extend on all sides of it, in length about 800 fathoms, and in width about 400 fathoms; the greatest depth is 120 fathoms.

The descent into these mines is extremely commodious. For the first thirty fathoms it is by a spacious stair-case carried down the sides of a shaft, at the bottom of which is an object that attracts general attention, and is really worthy of admiration. It is a spacious chapel, with an altar, and figures of Monks performing mass, with divers other figures in the attitude of prayer, and monuments, crucifixes, pillars, &c. against its sides, all hewn out of the solid

salt, and of such antiquity that no tradition records when it was executed.

I was particularly astonished by the uncommon dryness and hardness that prevailed, and this I found generally the case throughout the mine. From the chapel the descent is mostly by steps hewn out of the salt, or accompanying rock. The levels are on a magnificent scale, perfectly straight and regular; eight or nine feet in height, and nearly as many in width. The blocks and barrels of salt lying about and piled away in them, give them the appearance of store-cellars.

On reaching the bottom of the mine, another object pointed out to travellers as being worthy of observation, is the *lake*, a considerable basin of water with a large excavation over it; the salt bed having been very steep in that part. A boat is kept on this water for the purpose of traversing it.

On the occasion of the visit of the Emperor of Russia, when on his way to the Congress in 1814, the mine was illuminated, and in this part there was music and fire-works; the effect of the whole, from the accounts, must have been very magnificent.

Some of the excavations in the upper salt bed are several fathoms square, and are certainly very striking objects; and the miner will not fail to be attracted by their method of supporting the ground by means of immense solid trees, piled horizontally in cross layers,

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but this practice is now, in a great measure, done away, by leaving wherever they conveniently can, arches of salt, which are not affected by the weather, as the accompanying marl is.

The salt is of the description called rock salt. It occurs in beds which run east and west, and in general dip to the southward. In this, however, they vary, being much disordered.

They distinguish three beds, having each their peculiar character, and varying in the quality of their salt.

These beds are known by the names of

The Grünsalz bed ;

The Spyzasalz bed ; and

The Szybickersalz bed.

The Upper or Greensalt bed, is so much broken and disordered as to form a sort of *stockwerk*, the parts being separated from each other. The general form of its parts is nearly round, that is, of equal dimensions ; some of them are many fathoms in diameter, and present considerable excavations. I observed, on an inspection of the plans at the mine, that all these parts have nearly the same inclination. These separated pieces, lying above and by the side of each other, are first found at the depth of twenty or twenty-five fathoms under the surface, and descend to that of about sixty or sixty-five.

The quantity of salt obtained from this bed

has been immense, as the excavations on it fully testify. It is, however, not pure in quality, being much intermixed with earthy matter. If the earths with which it is mixed are not very perceptible, no notice is taken of them, but the whole is broken and sold together; if, on the other hand, the mass is very foul, it is left under-ground. It takes its name of *grünsalz* or green salt, from its being of a greenish colour.

The middle or *spyzasalz* bed, is less disordered than the *grünsalz*; its parts are much flatter, and not so considerable in depth in proportion to their other dimensions. The thickness may be about five or six fathoms. The salt from it is of a greyish colour; it is of a finer grain, and much more pure than the green salt.

The lower or *szybickersalz* bed, has considerable undulations, but is not broken. It is composed of two or three separate layers, which may be three or four fathoms in thickness. Its salt is for the most part perfectly clear and pure; some blue gypsum occasionally breaks with it.

The strata above these salt beds are chiefly clay or loam, with a thin bed of sand: the mass between them is a marl, varying in colour and hardness. In this shells sometimes occur; and near the lower bed some beautiful clear crystals of salt, from one to four inches square, are occasionally found.

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The mode of working these beds, is as follows:—The green salt bed is so much disordered; that levels are driven in different directions, for the discovery of its parts or fragments. These levels are very spacious, and are driven with great regularity. I remarked a singular mode of carrying them through the salt body where it occurred. The centre of the fore-breast was left standing, and a groove, of perhaps two feet in depth, was made round it with the pick. Thus freed on all sides, a large hole was bored in the centre, and the whole was thrown down at one blast. The blocks of salt prepared for sale, are obtained by making perpendicular cuts in the body of salt with the pick, as high as the bed will admit of, or as may be convenient for the miners to work; these cuts are then intersected by others carried horizontally, and the square pieces into which the pillars are thus divided, are detached by cutting a little at the back with the pick and then driving in wedges. They are then hewn into the form required.

Two sizes of these blocks were pointed out to me, the one or the other was obtained as the purity of the salt body would admit of.

The largest, called *balvanen*, are said to weigh four or five cwt. each, and are of a long cylindrical form, for the convenience of transport.

The others, called *formatsteine*, are long four sided pieces, weighing from 90 to 100 lbs. each.

These blocks are exported without cases, and are so solid as not to be affected by the weather. The small that falls in cutting and dressing them is packed in casks, but the blocks are preferred by merchants, as the casks are liable to be opened and pilfered by the carriers.

The salt blocks and casks are drawn through the under-ground levels or galleries, by horses, of which I was told there were about thirty in the mine.

From the depth of thirty fathoms they are raised to the surface through a perpendicular shaft, by a singular old whim, worked by six horses. It consists of a large horizontal wheel with two rows of teeth, which work an upright one attached to the cage.

The blocks are slung in cords; the weight raised at a time was said to be from 25 to 30 cwt.

There is only one footway into the mine, having a grating and small building over it. The men are strictly searched on leaving it. They all work by the job, and receive a part of their earnings in corn.

The water of the mine is drawn to the surface in sacks made of hides. It is so fully saturated with salt, that it deposits crystals as it flows through the landers in the mine. Stalactitical masses are also formed from its droppings. The crystals are perfect cubes; I observed them in several places prettily grouped.

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Such is the apparently inexhaustible store of the rock salt, that the mine water, which is by no means inconsiderable in quantity, is allowed to run to waste at the surface.

A handsome evaporating house was built during the time that these mines belonged to the Saxon and Austrian governments jointly, and fitted up with pans and every thing necessary; but it was soon found that the salt obtained by this process was much dearer, owing to the cost of the fuel required, than the rock salt from the mine: and as there was no scarcity of the latter to be apprehended for some centuries, the plan was abandoned, and the building is useless. Should they ever be obliged to resort to the process of evaporation, it is not likely that there will be any deficiency of saturated water, as from the quantity of impure salt from the green salt bed that is left underground, it may easily be produced by conveying fresh water into the mine.

These mines belong to the Emperor of Austria; they are situated in the province of West Galicia, which fell to his lot at the partition of Poland at the peace of 1809, after the battles of Aspern and Wagram. Part of West Galicia was taken from Austria, and annexed to the Duchy of Warsaw, which belonged to the King of Saxony. The mines, from that time till the peace of Paris, belonged jointly to the two governments, and a Saxon Commissary resided at Wielitska.

The Wielitska mines, I was told, produce at present about 25,000 tons of salt annually, but that double this quantity might be raised if it could be disposed of. It was observed, that by attempting to keep the price too high, their sales had of late been much curtailed, as the Liverpool salt had found its way to Warsaw and the north of Poland. A contract, I was informed, had just been entered into with the Emperor of Russia for the supply of his new kingdom with 25,000 tons a year for five years, at eleven Polish florins per cwt., which is about equal to £6 per ton.

There are likewise salt mines at Bochnia, about fifteen miles from Wielitska, but they are not so productive as the latter; the beds are much steeper, and not so thick.

The salt is sent to Cracow, and from thence down the Vistula.

In Mr. de Lill's collection, I remarked some specimens of native sulphur from a bed near Cracow.

On the Salt Mines of Salzburg.

On the 26th of November, 1814, I visited, in company with a friend, the salt mines of Hallein, distant about eight miles from the town of Salzburg, and the principal of the district. From the town of Hallein we ascended a steep mountain over a commodious road, formed by the King of Bavaria, to the church of Durren-

berg. The view from this elevated situation of the Vale of Salzburg, and the bold limestone rocks of the Unterberg and surrounding country, certainly the most picturesque in Germany, is most delightful.

In a cottage near the church, we were furnished with dresses, and when equipped à la Saxonne, entered the mine by a shallow adit, having its name Freudenberger Stolla engraved over the entrance.

The first part of this level was elliptically arched, and six feet and a half in height from the channel for the water. As we entered the salt country, its sides and roof were strongly timbered, which the salt is said to preserve; it still continued lofty and commodious. After thus travelling at our ease between three and four hundred fathoms, we arrived at the top of an inclined shaft, which we descended in a most singular and ludicrous manner. About the centre of the flat wall of the shaft, two smooth pieces of wood, like the sides of a ladder, were laid solid, with some planks on the outside of each, and a small narrow footway of sunken steps between. Over the platform on one side was a strong rope, on the other a rail, for the convenience of those that ascend. The descent was performed sitting; or rather reclining on the centre pieces, the legs and feet resting on the platform; and by holding the rope in the right hand, which was protected by a string glove, we were enabled to slide down at

the pace that was most agreeable. This may be regulated by the position of the body ; ours was very rapid, and but for the caution of our attendant, who led the way, would, no doubt, have been still more so. It is, however, by no means dangerous, as by planting the left heel in the steps of the footway, the pace may instantly be stopped. Several persons may thus descend in a string, the one resting on the shoulders of the other.

In this manner we descended through three shafts, upwards of one hundred and fifty fathoms.

The underlie, or angle of inclination of these shafts, was not the same in all. That of the first was said to be 43 degrees ; the second, at an angle of 49°, we found to be so steep that we were obliged to throw our bodies completely back, to prevent ourselves from going too fast. About the middle of the third flight we turned out to visit one of the kammern or chambers, in which the fresh water, conveyed into the mine from the surface, is inclosed for the purpose of dissolving the salt which is much intermixed with clay. In our way we passed two or three basso relievos of Bishops of Salzburg, and a tablet to commemorate the visit of the Emperor. These are in stone, and were conveyed there from the surface. The salt rock was not sufficiently solid to admit of sculpture.

The chamber was six feet and a half high,

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and from six to seven hundred fathoms in circumference. The largest is said to exceed a thousand fathoms.

The salt stone is so intermixed with clay and gypsum, as to form quite a breccia. As it cannot be obtained sufficiently pure for use, these chambers are filled with fresh water from the surface, and carefully closed up, when in the course of five or six weeks the water becomes fully saturated. It is then drawn off as it may be required by the boiling houses, which are in the town of Hallein, and the salt is obtained in the usual way by evaporation.

The salt stone being dissolved, the clay falls to the bottom of the chamber, which is well stamped, after the water is drawn off, and a fresh floor formed. Thus the chambers continue to rise through the salt country a few inches at each filling. There are in all thirty-four chambers in the mine, but few only are full at the same time, as it requires a considerable time to fill them with water, and to clear and prepare them after they have been used.

The salt country, I was informed, might be from two hundred and fifty to three hundred fathoms in depth.

There are seventeen levels driven from the surface into the mine at different heights, for the convenience of supplying it with fresh water, and taking it off when saturated.

Our journey out of the mine by one of these adits, was equally pleasant and amusing with

our descent. Seated across a long plank placed on four wheels, and having a swing beam beneath it for the legs to rest on, we travelled at a rapid pace upwards of 1200 fathoms through the level; the carriage running on a wooden rail road, was drawn by a man, two boys assisting him by pushing behind. The level was in excellent repair, and well timbered; about four feet wide at the bottom, tapering to two feet at the top.

The director of the Hallein works informed me that their annual produce amounted to about 15,000 tons, and that the other salt works in the country at Berchtesgaden, Rosenheim, &c. might yield together about double this quantity; the price I was told was four florins per cwt. and of this one half might be clear profit; thus yielding a considerable revenue to the sovereign. Some of the salt stone is sold in the country in its native state, for the use of horses and cattle, particularly that from the Berchtesgaden mine, which is the most solid. The greater part of the prepared salt is sent into the Austrian dominions by means of the River Salza, which is rendered navigable at Hallein, and communicates with the Danube. A part is likewise sent overland to Bavaria, and into the Tyrol.

At the moment of our visit, we found the utmost anxiety in the mine agents and directors as to their future fate. The Province of Salzburg, which was formerly an independent

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Bishopric, having been transferred at the peace of Amiens from Austria to Bavaria, the Austrian agents, who had then been dismissed, were now looking out for the country to be restored to their sovereign by the decision of Congress, and to their being replaced in their situations.