XXXV.—*Rough Notes on the formation of Nitre, as observed in the North Western Provinces of India.*

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A CLASS or caste of men, called *sorawallahs*, from the Hindu word *sora*, meaning nitre, make it the business of their lives to collect the raw material, manufacture, and sell the salt, either

for local use, as a cooling agent in frigorific mixtures, or for exportation.

The *sorawallah* goes about the village, examining the small surface drains which issue from holes in the mud-wall, usually found around native dwellings and their cow-houses; when he detects a faint white veil-like patch of crystalline formation, on or near the dark-coloured borders of these little drains, he knows that a considerable quantity of nitre exists, on or near the surface of all the surrounding earth; he accordingly proceeds to scrape off a very thin layer of the surface soil, which he carries away to his place of manufacture, as soon as his morning's collections are finished. On arriving there, the impregnated earth so collected is thrown into an earthen vessel containing either water, or water which has been poured off from previous supplies of similarly impregnated earth. When the water so used is pretty well saturated, it is poured into shallow pans of unglazed earthenware, in which it is then exposed to the combined influence of hot winds and the solar rays; these cause rapid evaporation, and the formation of crystals of nitrate of potash, which, after one or two more crystallisations, are ready for sale. The mother-liquor, on being further evaporated, yields a proportion of common salt, varying from one to seven or nine per cent. The *sorawallah* makes fresh collections from precisely the same spots of ground, from week to week, year to year, and from generation to generation, after the manner of the eastern world; the production of nitre is constant so long as the place continues to be inhabited; it even continues to appear in large, though gradually decreasing quantities, for years after the village may have been deserted. The intervals at which fresh collections may be made from the same spot, vary in different localities, and in different seasons of the year, from one to seven, ten, or more days. Before suggesting any theory of the mode of formation of this nitre, it will be necessary to direct attention for a few moments to some points in the physical geography of the country, and in the economy of a native village, which differ widely from anything seen in Europe.

Nitre is found in the plains of India, being most abundant in the parts most distant from the mountain ranges. The soil in these parts is composed of a very uniform alluvium, or river-sand; for a depth of more than 200 feet, the uniformity of

this is only broken by occasional thin layers of clay, indicating former river courses, and still more rarely by beds of rough, nodular, friable, stony masses, called *kunkur*,* each nodule of which is made up of granules of carbonate of lime so agglomerated that they enclose much of the surrounding sand, the proportion of carbonate of lime varying from fifteen to seventy per cent. These beds lie in a horizontal plane, at depths varying from one to twenty feet; they are from six inches to three or four feet thick; from one to three yards wide; and from one to several miles in length, with occasional interruptions. The yield of nitre is abundant only where these beds of *kunkur* exist in the soil, and where at the same time the natural water level is from twenty to forty feet below the surface. In parts where the surface of the well-water is only a few feet below the level, there no nitre is gathered; it is probably carried away and diffused as soon as formed. Where, on the other hand, the water level is more than twenty feet from the surface, all the watery parts of fluids thrown on the sandy surface are drawn to the surface and evaporated by the powerful sun, the solid particles remaining on the surface, to be gathered or washed away when the new rain falls.

Climate.—For eight months in the year no rain falls in the nitre-producing parts of India; the soil is exposed to the continuous influence of a dry wind and a burning sun; during the remaining four months it is exposed to alternations of heavy tropical storms of rain with thunder and lightning, and a burning sun. The rain generally falls so rapidly that it rushes off the surface of the earth into neighbouring rivers; some, however, soaks for a varying distance into the soil, where it dissolves any soluble material it may come in contact with, leaving it again on the surface as the water is drawn up and evaporated by the sun's influence. A greater quantity of nitre is collected in the rainy season than in any other, although it is

* These beds of "*kunkur*" are interesting as being the only stone-like formation seen for hundreds of miles along the left bank of the Ganges; as being the only available source of lime in the p'ains of India for ages; and also in their formation. In the extreme hot dry season, water, holding bicarbonate of lime in solution, appears to be drawn up from the depths of the earth; as this approaches the surface the whole of the water and part of the carbonic acid being driven-off granules of carbonate of lime are deposited, which coalescing imperfectly form these rough granular nodules.

evident that much more must at the same time be washed away.

The Village.—The nitre-producing parts of India are more densely populated than England; the villages are large, and are made up for the most part of mud-houses surrounded by a mud-wall, which generally encloses the dwellings of a whole family, including uncles and aunts and their families, as well as grand parents and grand children; every family will have at least one pair of plough-oxen. The only drains from these houses are the small surface ones before alluded to, and the only fluids which pass by these drains are urine and the small quantity of refuse water brought to the house for culinary or drinking purposes;* these drains open on to a small open plot of ground where the drainage diffuses itself, and is rapidly dried in the sun, the only other domestic refuse which finds its way to this spot being the daily contribution of wood-ashes, which results from cooking processes, any refuse food, or leaves used as plates by these people, being rapidly devoured by hungry eastern dogs, crows, or their own cattle. It now appears that we have all the necessary elements for the continuous production of nitre; there is urea in abundance, which, in the presence of carbonate of lime is probably converted into nitric acid and nitrate of lime by the influence of the severe thunder-storms in the rainy season, and possibly also by the active chemical influence of the sun's rays at other seasons. The nitrate of lime so formed is probably again decomposed by solution of carbonate of potash, giving rise to nitrate of potash, the solution of which is drawn to the surface of the earth in the ordinary course of evaporation, where it crystallises and is gathered by the *sorawallah*. The small amount of chloride of sodium associated with the nitre is also probably derived from the urine.

The evidence in favour of this theory is:—

1stly. That no other known source of nitre exists.

* All things requiring washing in a native house are carried to a neighbouring bank. All coarser refuse, as broken pots, &c., are thrown into a hole made when the earth was dug to build the house. Ordure does not find a place in this plot of ground, as a rule, for it is the custom for all members of an Indian household to retire once daily, in the early dawn, to the "bushes," or to a field, sheltered by a high growing crop, where they at once defecate and manure their land; at all other times in the day, urine is voided in the little open drain or gutter. Cow-dung does not find a place there, it being invariably collected, dried in the sun, and used for cooking purposes.

2ndly. That nitre is found only in and near populous villages; that it continues to be found on the same spot of ground so long as it is inhabited, and gradually ceases when a village is deserted.

3rdly. That the process is imitated successfully in some of our Indian gaols, where the expense of removing urine to a distance has been avoided by setting apart a plot of ground to receive it; lime is then added to this, in case it does not exist in the soil naturally, and all the refuse wood-ashes are thrown in the same place. Nitre is formed, collected, and manufactured for sale to cover the cost of production.