

rations through the London clay, into porous beds of the plastic clay formation, or into the chalk.

Important treatises upon the subject of Artesian wells have lately been published by M. Héricart de Thury, and M. Arago, in France, and by M. Von Bruckmann, in Germany. It appears that there are extensive districts in various parts of Europe, where, under certain conditions of geological structure, and at certain levels, artificial fountains will rise to the surface of strata which throw out no natural springs, and will afford abundant supplies of water for agricultural and domestic purposes, and sometimes even for moving machinery. The quantity of water thus obtained in Artois is often sufficient to turn the wheels of corn-mills.

In the tertiary basin of Perpignan, and the chalk of Tours, there are almost subterranean rivers, having enormous upward pressure. The water of an Artesian well in Rousillen rises from thirty to fifty feet above the surface. At Perpignan and Tours, M. Arago states that the water rushes up with so much force, that a cannon-ball placed in the pipe of an Artesian well is violently ejected by the ascending stream.

In some places application has been made to economical purposes, of the higher temperature of the water rising from great depths. In Wurtemberg, Von Bruckmann has applied the warm water of Artesian wells to heat a paper manufactory at Heilbronn, and to prevent the freezing of common water around his mill-wheels. The same practice is also adopted at Alsace, and at Constadt, near Stuttgart. It has even been proposed to apply the heat of ascending springs to the warming of green-houses. Artesian wells have long been used in Italy, in the duchy of Modena. They have also been successfully applied in Holland, China, and North America. By means of similar wells it is probable that water may be raised to the surface of many parts of the sandy deserts of Africa and Asia; and it has been in contemplation to construct a series of these wells along the main road which crosses the isthmus of Suez.

I have felt it important thus to enter into the theory of Artesian wells, because their more frequent adoption will add to the facilities of supplying fresh water in many regions of the earth, particularly in low and level districts, where this prime necessary of life is inaccessible by any other means; and because the theory of their mode of operation explains one of the most important and most common contrivances in the subterranean economy of the globe, for the production of natural springs.*

By these compound results of the original disposition of the strata and their subsequent disturbances, the entire crust of the earth has become one grand and connected apparatus of hydraulic machinery, co-operating incessantly with the sea and with the atmosphere, to dispense unfailing supplies of fresh water over the habitable surface of the land.

Among the incidental advantages arising to man from the introduction of faults and dislocations of the strata, into the systems of curious arrangements that pervade the subterranean economy of the globe, we may further include the circumstance, that these fractures are the most frequent channels of issue to mineral and thermal waters, whose medicinal virtues alleviate many of the diseases of the human frame.

Thus, in the whole machinery of springs and rivers, and the apparatus that is kept in action for their duration, through the instrumentality of a system of cu-

riously constructed hills and valleys, receiving their supply occasionally from the rains of heaven, and treasuring it up in their everlasting storehouses, to be dispensed perpetually by thousands of never-failing fountains, we see a provision not less striking than it is important. So also in the adjustment of the relative quantities of sea and land, in such due proportions as to supply the earth by constant evaporation, without diminishing the waters of the ocean; and in the appointment of the atmosphere to be the vehicle of this wonderful and unceasing circulation; in thus separating these waters from the native salt, (which, though of the highest utility to preserve the purity of the sea, renders them unfit for the support of terrestrial animals or vegetables,) and transmitting them in genial showers to scatter fertility over the earth, and maintain the never-failing reservoirs of those springs and rivers by which they are again returned to mix with their parent ocean. In all these circumstances we find such evidence of nicely-balanced adaptation of means to ends, of wise foresight, and benevolent intention, and infinite power, that he must be blind indeed who refuses to recognize in them proofs of the most exalted attributes of the Creator.—*Buckland's Bridgewater Treatise.*

HISTORICAL.

QUEBEC, LOWER CANADA.

QUEBEC possesses an historical interest, to which no other city in the Western World has a similar claim. It need scarcely be added that before its proud citadel are the celebrated plains of Abraham, where Wolfe fought, conquered, and died, "with his glory around him."

The city of Quebec, the capital of Lower Canada, and the Gibraltar of America, stands on the extremity of a precipitous cape, in latitude 46° 54' N. longitude 71° 5' W., on the St. Lawrence, which, five miles below, is divided by the Island of Orleans, into two channels, each about a mile broad. Immediately opposite Quebec, where the river makes a sudden bend, it is little more than half a mile broad, but the depth of water is about 25 fathoms. Between this and the Island of Orleans is formed the splendid basin of Quebec,—somewhat more than five miles long, and about four broad in the widest part. On sailing up the river, we see nothing of the city, until we are nearly in a line between the west Point of Orleans and Point Levi. Quebec, and its surrounding sublimities, then burst suddenly into the vast landscape; and the grandeur of the first view of the city is a magically impressive picture.

"An abrupt promontory, 350 feet high, crowned with an impregnable citadel, and surrounded by strong battlements, on which the British banners daily wave,—the bright steeples of the cathedral and churches,—the vice-regal chateau, hanging over the precipice,—the house-tops of the upper town,—the houses, wharfs, *hangards*, or warehouses, &c., of the lower,—a fleet of ships at Wolfe's Cove, and others at the wharfs,—steamers,—multitudes of boats,—several ships on the stocks,—the white cataract of Montmorency tumbling into the St. Lawrence over a ledge 220 feet high,—the churches, houses, fields, and woods of Beauport and Charlebourg,—mountains in the distance,—the high grounds, church, and houses of St. Joseph, some Indian wigwams near Point Levi, with some of their bark canoes on the water, and vast masses of timber descending on the river from the upper country,—may impart to the fancy some idea of the view unfolded to the spectator who sails up the St. Lawrence, when he first beholds the metropolis of the British empire in America."

On landing at Quebec, and ascending from the lower to the upper town, we pass through narrow,

* In common cases of Artesian wells where a single pipe alone is used, if the boring penetrates a bed containing impure water, it is continued deeper, until it arrives at another stratum containing pure water; the bottom of the pipe being plunged into this pure water, it ascends within it, and is conducted to the surface through whatever impurities may exist in the upper strata; the impure water through which the boring may pass in its descent, being excluded by the pipe from mixing with the pure water ascending from below.

• British America. By John McGregor, Esq., vol. ii. p. 474.