

up in the stone. These were all arranged on the same vertical line. The experiments were made in twenty mines, extending over a surface of about 25 square miles. The instruments were examined several times monthly, and the mean of these observations taken for each month, and, afterwards, for each year. The result was, that between 1821 and 1831 more than four hundred observations were taken, at levels varying between 65 feet and 1100 feet; and M. Reich concluded from them that the increase of temperature was represented by 1° for about 140 feet.

Similar experiments made in the mines of the Ural in Siberia have conducted M. Kupffer to a result superior by nearly one-half, as to the rapid augmentation of heat—namely, 1° for 65 feet. On the other hand, in some of the Scotch mines, the same experiments have shown an increase of 1° for 205 feet. And, finally, it has been ascertained in England that the temperature increases much more rapidly in coal than in metallic mines.

The diversity of the results which we have thus recapitulated proves, that observation of the temperature in the interior of mines does not afford a perfectly reliable basis for calculations.

The Artesian wells,* now established so generally over Europe, furnish us with a far more exact method than the preceding of work-

* [Artesian wells are so named from Artesia, now *Artois*, in Franco, where they are of frequent occurrence. It is supposed that the Chinese have been long acquainted with them, and for centuries they have existed in Austria, though the boring for them was there conducted in a very rude and empirical manner. Nor was it possible, until geology assumed a definite position as a science, for the engineer to decide with any degree of certainty whether a supply of water could or could not be obtained by this means in any particular district.

The principle of the Artesian well is simple; namely, to bore through the upper and non-retentive soil to strata containing water which has percolated from a higher level, and which is again forced up to that level through the boring-tube by hydrostatic pressure.

The wells supplying the fountains in Trafalgar Square, London, are bored through the upper clay into the chalk strata to a depth of 393 feet. At Grenelle, in the neighbourhood of Paris, the water is brought from the gault, at a depth of 1798 feet. The supply amounts to $516\frac{1}{2}$ gallons of water in a minute, and it rises with such force as to be propelled 32 feet above the surface. For such an effort as this a pressure is required which has been calculated to exceed fifty atmospheres at the bottom of the bore.

Since the French occupation of Algeria, Artesian wells have been successfully introduced into the Desert of Sahara, creating gardens in the midst of dreary wastes, and literally making the wilderness to blossom like a rose. These artificial oases invariably become the nuclei of large and prosperous Arab settlements, and their effect on the habits and manners of a nomadic race promises to be as beneficial as it is extraordinary.]