ART. XIII.—TRAVERTINE OR CALCAREOUS TUFA.—BY H. D. SEWELL, ESQUIRE, M. A.

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The accompanying specimen of Travertine was taken, by myself, in situ, from a small cove on the American side of the Niagara river, about a mile below the Falls, in which spot it is formed in considerable quantities, by the drip of the Limestone rocks of that district incrusting upon moss.

The great Geological formation of that section of Upper Canada, at least in the neighbourhood of the Falls, is a secondary Limestone containing organic remains,* and rich in Mineral springs. About one hundred yards below the Falls on the Canada side, a Sulphuretted Hydrogen Spring exudes from below the Table Rock, so rich in Sulphur as to deposit a thick slimy incrustation of that mineral on the objects with which it comes in contact, and very sensible to the olfactory nerves of those who pass by it in their adventurous excursion behind the falling sheet of water.—About a mile above the Fall, on the same side of the river, is another Spring of Carburetted Hydrogen, so pure and so copious that it readily ignites and burns with a large, brilliant, white flame, and might be applied to all the purposes of coal-gas. I had no opportunity of seeking for springs on the American side of the river, but as the strata are the same, I have no doubt they exist.

* Among the organic remains may be enumerated,—Encrinites, Ammonites, and Favosites. The Mineral contents are Columnar Limestone, Snowy Gypsum and Yellow Blende. This latter is found at the Whirlpool immediately opposite the formation of Travertine.

All travertines are formed from the deposits of water highly impregnated with Carbonic Acid, which has the property of dissolving the Calcareous matter of the rocks through which it percolates.—Rain water has a similar property, but independently of this, it appears to me that Carbonic Acid gas is formed in the Niagara Limestone and is taken up by the water. The Calcareous matter is supplied from the rock, and on coming into contact with the external air, is deposited on the moss of the old Limestone, to the growth of which it materially contributes. A new rock, also a Carbonate of Lime, is thus formed, rough and coarse, but highly useful as a building material, where, as in Italy, it is deposited in large quantities.

Most of the public buildings in Rome and its vicinity are formed of this material.—Among which we may enumerate those splendid edifices, rivals alike in magnitude and magnificence, the Coloseum and St. Peter's, the former the pride and wonder of the ancient, the latter of the modern world. The Temples of Pæstum, so ancient as to be venerable as antiquities, (before the Christian Era,) are also built of this everlasting rock.—The corroding hand of time seems to have no effect on this enduring material. The lapse of centuries which has crumbled the cement used in these buildings into dust, and formed from it a luxuriant soil for the growth of parasitic plants, has left the edges of the Doric fluted columns as sharp as when they issued from the Sculptor's chisel. No moss upon the surface of the stone itself proclaims the many hundreds, I may say, thousands of years which have passed by since first the Grecian architect raised on the foreign strand of Italy these temples of colossal magnitude.—But for the destructive hand of man we, of the nineteenth century, might have

contemplated these buildings, in the same perfect beauty in which they appeared to Augustus Cæsar.

Calcareous waters have been applied in Italy, at the Baths of San Filippo to the formation of very beautiful medallions, one of which, a fine specimen, was lately presented to the Museum, by a member of this Society. The formation of these medallions is thus described by Mr. Lyell:—"There are here (San Filippo) three warm springs containing Carbonate and Sulphate of Lime and Sulphate "of Magnesia. The water which supplies the bath falls "into a pond, where it has been known to deposit a solid "mass of stone, thirty feet thick in twenty years. It is from "these waters that the manufactory of medallions in basso "relievo is carried on. The water is conducted by canals into "several pits, in which it deposits travertine and sulphate "of lime. After being thus freed from its grosser parts, it "is conveyed, by a tube, to the summit of a small chamber, "and made to fall through a space of ten or twelve feet. The "current is broken in its descent by numerous cross sticks, "by which the spray is dispersed around upon certain "moulds, which are rubbed slightly over with a solution of "soap, and a deposition of solid matter like marble is the "result, yielding a beautiful cast of the figures formed in "the mould. The substance deposited is a calcareo-mag-"nesian compound, of a similar composition to the dolo-"mite of the North of England, but much purer." A similar deposit is found in Rome, on the walls of "Le Sette Sale," probably in ancient time a reservoir for the water which supplied the baths of Titus; there are there three distinct depositions of carbonated lime. The reservoirs are nine in number and of an immense size, and convey a tolerable idea of the magnificence of the baths they supplied.

We need not go far for the origin of this last named deposition. The waters for the supply of ancient Rome were conveyed to the city by aqueducts, from the Appenine Mountains,—the waters of which locality are highly impregnated with calcareous matter, and deposit annually in their course immense quantities of travertine.—Some of these aqueducts were of great extent—the length of one, under the modern name of "*Acqua felice,*" being computed at 22 English miles, and that of the Acqua Paulina at 30 miles.—The water in this long course would naturally deposit its grosser particles, while those of a less specific gravity would be retained to the last, and become incrusted on the walls and bottom of the reservoirs.

The waters of the Anio, the "Præceps Anio" of Horace, are highly impregnated with this calcareous matter, which it has deposited in vast masses and in concentric circles. The foam of the cataract of Tivoli forms beautiful pendant stalactites—but on the sides of the deep chasm into which the cascade precipitates itself, there is seen an extraordinary accumulation of horizontal beds of tufa and travertine from 400 to 500 feet in thickness. A very remakable instance of the deposition of this peculiar rock occurs in the Campagna di Roma, on the road to Tivoli, at the Lago di Solfatara, into which a small stream of tepid water flows continually from a smaller lake, a short distance above it. This water is highly impregnated with carbonic acid, which escapes from it in such quantities that in some parts the waters appear to be boiling. Sir Humphrey Davy states, in one of his last works, "that the water taken from the "most tranquil part of the lake, even after being agitated "and exposed to air, contains, in solution, more than its "own volume of carbonic acid gas, with a very small

" quantity of sulphuretted hydrogen.—Its high tempera-
" ture, which is pretty constant, at 80° Fahr. and the quan-
" tity of carbonic acid it contains, render it peculiarly
" fitted to afford nourishment to vegetable life. The banks
" of traventine are every where covered with reeds, lichen,
" confervœ and various kinds of aquatic vegetables—and,
" at the same time that the process of vegetable life is
" going on, the crystalization of the calcareous matter,
" which is every where deposited in consequence of the escape
" of carbonic acid likewise proceeds." There is, he con-
tinues, "no place in the world where there is a more strik-
" ing example of the opposition or contrast of the laws of
" animate and inanimate nature, of the forces of inorganic
" chemical affinities and of those of the powers of life."

The stream which flows from this lake fills a canal about nine feet broad and four deep, and may be traced along the Campagna to its junction with the Tiber, by a long line of vapour which rises from its milky waters.—It deposits travertine in this channel.

The growth of Stalagmites and Stalactites in caverns and grottos is another familiar example of calcareous precipitates.*

This interesting subject might be carried to a much greater extent, but I leave the discussion of it to those who are better skilled in the science of geology than myself.—I should not indeed have trespassed at all upon the time of this Meeting, but from an anxious desire as an officer of

* There is another rock called Tufa which is not calcareous, and owes its origin wholly to volcanic action, being in reality a norous lava. This rock, though bearing a similar name, is easily distinguished from the rock we have been describing.

this Society, of acting up to a suggestion made at a late meeting of the Class of Natural History, and by which as Curator of the Museum, I am peculiarly bound, viz. to offer at each meeting, a short description of such donations as may be presented to the Society, in the hope of exciting a greater degree of interest among the members.