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1828

MITCHELL (S.L.) & M'NEVEN
A
Chymical Examination
(W. J. al)

OF THE

MINERAL WATER

OF

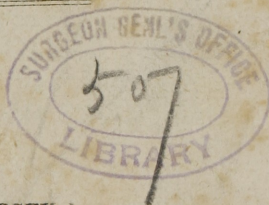
SCHOOLEY'S MOUNTAIN.

TOGETHER WITH

A PHYSICAL GEOGRAPHY

OF THE FIRST RANGE OF MOUNTAINS EXTENDING
ACROSS NEW-JERSEY, FROM THE HUDSON
TO THE DELAWARE.

BY DOCT'S. **SAMUEL L. MITCHILL**, & **WILLIAM
JAMES M'NEVEN**, OF THE CITY OF NEW-YORK.



MORRISTOWN, (NEW-JERSEY :)

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SCHOOLEY'S MOUNTAIN MINERAL SPRING.

This watering place has, for upwards of 30 years been celebrated as one of the most agreeable resorts for health and pleasure in the Union. Three spacious houses, built for the reception of company during the summer months, and provided with every accommodation for their comfort and ease, are now prepared for company. Beside these, a number of farm-houses in the vicinity of the Spring will accommodate those who prefer retirement, and furnish, together with the public house, suitable apartments, and board for between two and three hundred persons, the number which generally resort here in the months of July and August.

The undersigned, proprietor of the Heath-House, would give notice to his friends and the public in general, that his establishment will be open for the reception of VISITANTS between the *1st of June and the 1st of November*, annually. The Heath-House possesses great advantages in point of locality, being situated upon the top of the Mountain, remote from the street, and surrounded with full grown shade-trees. It has been long established as a house of accommodation, and from the increasing pleasantness of the place, by the growth of trees and other improvements constantly making, is surpassed by none at this or any other watering place. The arrangement of the house and furniture is particularly adapted to the convenience and comfort of Visitors. Baths and games of amusement, such as are usually found at watering places, will likewise be found here. The best Wines and Liquors will always be provided, as well as Brown Stout, and Philadelphia

Porter and Ale. A constant supply of Saratoga Congress Water, in bottles, fresh from the Spring, will likewise be kept. The course hitherto pursued by the undersigned, in the management of his establishment, both as respects the stile of cooking, and the attention and obedience of servants, will be strictly pursued in the future:—and how far that course has been approved, may be learned by the extensive patronage a generous public has afforded him; for which, he tenders his unfeigned and grateful thanks.

It is deemed unnecessary for the undersigned to say any thing of the medicinal qualities of the mineral water, or the salubrity of the mountain air, after two so distinguished members of the faculty have borne testimony of their valuable and healing properties; but he would refer to those who have visited here, bowed down with disease, and now enjoying the blessings of established health, the consequence, as they believe, of partaking of this agreeable beverage, and inhaling the elastic air, during a stay of a few weeks at Schooley's Mountain Spring.

To the votaries of pleasure, likewise, this place possesses great attractions, abounding with romantic and picturesque scenery, and affording an opportunity of meeting and associating with company the most gay and fashionable—in short, combining advantages, as great, if not superior, and being fully if not more desirable, than any of the numerous and multiplied places of summer resort in our country.

E. MARSH.

Heath-House, May 1st, 1823.

A PHYSICAL GEOGRAPHY

*Of the first range of Mountains, extending across the State of
New-Jersey from the Hudson to the Delaware.*

WITH SOME EXPERIMENTS

ON THE

Chalybeate Spring at Schooley's Mountain.

BY THE HON. *SAMUEL L. MITCHILL*, M. D. M. C. &c.

THERE had been so much conversation about Schooley's Mountain Spring, that in the beginning of July, 1810, I executed the desire I had long entertained, of visiting it.

Schooley's Mountain is part of the granitical chain which extends in a North-Easterly and South-Westerly direction, across the state of New-Jersey; it may be traced from the high-lands of New-York, towards the Hudson; its ridges divide the plains of Rockland county from those of Orange, being denominated the Harverstraw, Warwick, Skunemunk, and Sterling mountains, and being distinguished locally by several other names; beyond the Hudson in Westchester and Dutchess counties, it is called the Fishkill, and Peekskill mountains, Joe's hills, Anthony's nose, Sugar-loaf, break-neck-hill, and several other names. It trends away, first to the East and North-East, and then to the North, by Quaker-hill, separating the waters which fall into Long-Island Sound. Towards the Delaware, it separates the upper waters of the Raritan from those of Musconnetcong, and passing from Sussex, through Morris and Hunterdon counties, is called, somewhat to the Southward of Phillipsburgh, the Musconnetcong Mountain; the more noted portion of its midlong region is termed Schugl's hills, or Schooley's Mountain; the latter name is the most prevalent, and is derived from a family which was formerly a considerable proprietor of the soil there-about; the former appellation is probably a mere abbreviation or corruption of it.

This ridge discharges the water from its North-West side, partly through the Walkill, into the Hudson, a little to the Eastward of Esopus, after traversing Sussex county, in New-Jersey, and Orange

and Ulster, in New-York; part also empties into the same river through Murtirer's and Chambers' creek, near New Windsor, and another portion is collected into the Musconnetcong river, and running almost parallel with the mountain, falls into the Delaware, not many miles South of Easton. The water from the South-East feeds, as it passes between the spurs or transverse ridges, the Ramapough and the upper streams of the Passaic, which, after visiting Orange, Rockland, Morris, Essex, and Bergen counties, falls into Staten Island Sound, to the Southward of Newark. The stream called the Black River, beyond Mendham, and that termed South Branch, watering Dutch Valley, neither of them reach the Delaware, but empty into the Raritan some distance above Brunswick.

Thus these heights completely divide the waters of New-Jersey. Not a simple stream is known to pierce them. From their North-Western slope all these streams find their way into the Hudson and Delaware. From their South-Eastern declivity their currents travel to the ocean by Newark and Raritan bays. They have, however, no pretensions to be classed with the Shawangunk mountains, which are a distinct chain, and make part of the great Alleghany, that traverses the continent to the confines of Georgia. Nor have they any connexion with the Catskill mountains, which are themselves quite detached from the Shawangunk. Schooley's Mountain is of a more moderate elevation than either. Geometrical measurement has ascertained, that the height of Schooley's Mountain, above its amidial base, is more than six hundred feet; and a calculation made by approximation on the falls of water at the different mill-dams along the hurrying channel of the Musconnetcong to its junction with the Delaware, and on the descent thence to Trenton, make the position of that base to be nearly five hundred feet more above tide water: the elevation above the level of the ocean does not, therefore, in all probability, much exceed eleven hundred feet; and this is about the height ascribed to Anthony's Nose, in the high-lands of New-York, by Mr. Knight.

The elevation is nevertheless considerable enough to influence its temperature. The heats of Summer are not so great as in the valley draught, and less common, and snow falls earlier and lies longer than in the adjacent plains. The warmth of copious springs of fire water, as it issued out of the sand near the top of the mountain, was only 50 degrees, while the temperature of the water gushing from the briskest springs on the North side of Long Island, and drawn from the deepest wells at New-York, is 54 degrees. The spring water on the summit of Schooley's Mountain, is therefore four degrees colder than around New-York.

This mountain is not a mass of stratified rocks piled on each other from bottom to top. There is no peculiar difficulty in travelling over it. The predominating materials are clay and sand, forming a good loam, which, though generally not argillaceous enough for the formation of bricks, is, at the same time, gravelly enough for the growth

of grass and grain: yet rocks are thickly distributed over its face, and along its sides they are mostly detached, though some of them are of large dimensions; they consist chiefly of feldspar and quartz. The quartz is prone to be semi-pellucid, and is granular, or angular, resembling coarse Marine salt. The feldspar is mostly whitish, though sometimes reddish, and presents less of the polished fraction than the American feldspars usually do: it has the appearance of a more imperfect formation, or of having undergone a partial decomposition. The two ingredients make up the bulk of the rocks.—Many masses may be examined without observing a vestige of mica, abundant as mica is almost every where in these parts, with the mixtures of feldspar and quartz. In our primitive rocks it is remarkably deficient. Here, now and then a shistus or hornblende is found embodied and compacted with the quartz and feldspar; grains of yellow pyrites also sometimes occur; rust, ochre, and other indications of iron, are dispersed extensively, both through the rocks and the soil. Iron ore is indeed so plentiful, that furnaces are in operation both in the Eastern and Western districts of the chain. Much of it is magnetical, and its action is so powerful upon the needle, that surveyors of land often find it very difficult to employ the compass. It would be possible to collect great quantities of the magnet of other ores of iron in middle regions. Towards the foot of the hills, limestone is found, skirting the valleys along, and is calcined in quantity sufficient for all economical uses.

Among the natural productions there-about, are masses of excellent flint-stones. They lie along the valleys and side-hills, where they have been washed bare, and serve both in quantity and quality for musketry. They are more pure, and of a better fraction, than those contained in the limestone near Niagara; and when this important article of public defence shall be thought worthy of being improved by the citizens, there seems to be in Jersey a good supply.

The feldspar appears to be of that variety which is fit for the porcelain manufacture. The rocks may be split by gun-powder, and afterwards comminuted by the hammer. There is little mica to impede the separation, and the quartz can be easily divided from the feldspar. If this should prove to be the real peunse, it will be of great consequence in the progress of the arts.

A turnpike road has been completed from the City of Jersey, at Powles-Hook, to the summit of Schooley's Mountain: the travelling is excellent the whole distance. This is just fifty miles from New-York City, estimating the Hudson to be two miles wide. The distance to Newark is nine—to Springfield, seven—to Chatham, five—to Morristown, seven—to Mendham, six—to Black-River, six—to Dutch Valley, five—and to the Mineral Springs, on the Eastern or the further side of the mountain, three miles; through such a succession of thriving villages, and amidst a country pleasingly chequered with forests and farms, the rise of the first five hundred feet is surmounted in about forty-seven miles. As the traveller passes

over a surface of easy elevations and depressions, the remaining six hundred feet are ascended in less than two of the remaining miles, between Dutch Valley and the summit. The principal part of the remainder is a descent to the spring on the opposite declivity.

An able horse will bring a chair hither from New-York, in a Summer's day, or return hence, between the rising and setting of the sun. From the top of the mountain, one finished turnpike is continued Northward to Sussex, another Westward to Easton, and a third Eastward to New-York: it is in contemplation to open a fourth from the same point, to proceed in a course Southwardly direct to Trenton.

The Mineral Spring which has been mentioned, has given much celebrity to the neighbouring region. It is said to have been known to the native Indians, and to have been employed by them as a remedy. The white people have resorted to it almost ever since the settlement of the country; remarkable cures are ascribed to it, and some persons have been in the habit of visiting it season after season, for the purpose of being benefited by its wholesome properties. It is situated in the town of Washington, in the county of Morris. It is, in strictness, a rill which issues from a fissure in the perpendicular side of one of the above described rocks. On its Eastern exposure the place of discharge is perhaps between forty and fifty feet above the level of a brook which gurgles over the stones, and foams down the rocks in its channel beneath, the extremity of a wooden leader is so adapted to the crack, as to receive the water and convey it to the platform, where the drinkers assemble, and to the recesses within the bathers retire.

Its temperature is rather more than six degrees warmer than that of the spring water next to the summit. The mineral water, as it pours from the spout, possesses a heat somewhat warmer than fifty-six degrees. This is about the same which the slower springs and shallower wells around New-York possess.

The quantity of water which it affords, can easily be measured by experiment. It appeared to discharge a gallon in about two minutes and a half: at this rate the amount would be twenty-four gallons per hour; but allowance is to be made for leakage and waste, inasmuch as the conduit does not collect the whole. Suppose this to be six gallons more: then the quantity running out will amount to thirty gallons per hour. Some trials are reported to have shown a rather more abundant flow. On the whole, it may be stated with tolerable correctness, that the fountain within the bowels of the mountain emits from this opening a quantity of water not varying greatly from a barrel per hour, or six hogsheads per day. The quantity is not observed to vary under any changes of season or weather. The spouts which convey the water, are lined with a yellowish deposit: the like sediment incrusts the reservoirs at the bathing house: the earth and stones through which the water soaks away, present a similar ochreous appearance. When the boards contain astringent matter, a dark purple or blackish is formed.

The presence of iron being thus indicated, a few experiments were made to determine the matter more clearly.

A bright blue was produced, on adding the prussiate of potash to the water.

Green leaves of the common chesnut tree, (*fagus castanea*) on being bruised and infused in the water, formed a pale purple.

Those of chesnut-oak, (*quercus prinus monticola*) yielded a brighter purple.

Those of the sumach, (*rhus glabrum*) immediately formed a deep purple.

Hickory leaves, (*Juglans vulgaris*) made a faint dusky hue.

Black oak leaves, (*quercus nigra*) struck a darker colour.

Butternut leaves, (*Juglans cinerea*) afforded a dusky brown.

The waters of the spring mixed with brandy, made a mixture of a dark and unsightly colour.

An infusion of green tea, formed browns, purples, and blacks, according to its strength and portion.

The chalybeate character of the water being thus established by so many tests, attempts were made to ascertain whether there was any gaseous impregnation.

For this purpose glasses were inverted in a convenient vessel, securing the stream immediately from the spout, but not a bubble of air was collected, other than common spring water affords.

To determine whether any carbonic acid was combined with the water, in a form not spontaneously separable, lime water was mixed with it; but no change of colour was perceptible in the mixture.

Various proportions of the spring water and lime water were mingled in repeated experiments, without effecting any cloudiness, or causing any precipitate.

Afterwards, as a test to the goodness of the lime-water, the milky hue and carbonic precipitate of the lime was instantly produced, by breathing through a tube into the mixture of waters, air which had undergone the respiratory operation of the lungs, there was thus no evidence of any carbonic acid at all. When the water of the spring was suffered to stand in the open atmosphere and acquire the Summer temperature, by receiving twenty or more degrees of heat, some air bubbles were distinguishable on the sides of the vessel, but they were only such as any cold water would exhibit under equal circumstances.

As there was no calcareous incrustation at the spring, there was reason to believe the water destitute of lime; on adding to it oxalic acid, there was no change of colour produced; whence it may be inferred that lime makes no part of the constitution of this fluid.

To enable a judgment to be formed, whether any other earths were combined with the water, soda and potash were severally and repeatedly added; the precipitates were, however, so small, and so slowly produced, that they were very inconsiderable, and that there was no metallic impregnation except that of iron.

The nitrate of silver caused a whitish appearance, but not in so inconsiderable a degree as it does in the water in New-York, constantly drank by the inhabitants; the cloudiness was indeed not more considerable than rain water along the sea-coast is occasionally known to present, when subjected to the same test; the tinge of muriatic acid hereby indicated, probably arises from a faint solution of sea-salt. There is, notwithstanding, a weak acid of some kind in the Schooley's Mountain mineral water. If litmus paper be exposed to the water as it issues from the rock, the blue is gradually changed to a redish; and on the addition of an alkali, the acquired colour vanishes. What the nature of this inconsiderable of uncombined acid may be, is not perfectly easy to determine. Its presence is attended with the flavour which water derives from running over decayed leaves, and draining through a soil abounding with the living and dead roots of trees, shrubs, and sylvatic plants. Former experiments have proved to me the existence of an acid in the rotten wood which overspreads the American forests, and water passing through a stratum of vegetable mould, through which it is strained, and carries the flavour of it to the fountain.

The peculiarities of this feeble acid, like that of numerous others we meet with in practice, does not seem to be defined in chymistry, as yet, by discriminating characters.

The iron of the mineral water is very easily separated. Exposure to the atmosphere is followed by a metallic precipitation.—Transportation to a distance, as bottles are commonly corked, is attended with a deposition of the iron. The water, after having been carried to New-York, when subjected to experiment in my house, gave no evidence of a chalybeate quality—when tested by the prussian alkali and spirituous tincture of galls, this same water, after being boiled in a kettle, makes excellent tea. The heat of ebullition seems to separate the ferruginous ingredient, and the infusion is thereby freed from all dusky or black tint: still, if this same infusion of green tea is mixed with water fresh from the spring, a dark and disagreeable hue is instantly produced. A short exposure to the heat of 212° , thus converts this mineral water into good tea water: it is employed for this purpose occasionally.

To valetudinarians and parties of pleasure, this region affords the double convenience, from the level of tide-water to a desirable height, and of retiring from the maritime exposure to an interior region, by a short journey. Persons who wish an elevated residence, somewhat remote from the sea coast, may here be exactly suited.

If there is any thing that deserves the name of a pure chalybeate water in the world, this would seem to be such a composition. The iron appears to be united with the water, without the aid of carbonic, or indeed any other acid; for the weak acidity detected by litmus, can scarcely be considered as contributing to its solution. Some part of the iron ore universally diffused among the minerals hereabout, is in a state proper for water to act upon, and to produce the martial impregnation, remarkably free from other admixtures.

CHEMICAL EXAMINATION

OF THE

Mineral Water at Schooley's Mountain.

BY WILLIAM JAMES McNEVEN, M. D.

Fellow of the Literary and Philosophical Society; Professor of Chemistry in the University of New-York, &c.

THE mineral water of Schooley's Mountain, in New-Jersey, has of late years acquired so much just celebrity in cases of calculous concretions, that it is equally an object of interest for the physician and chymist to ascertain the nature of a natural production which affords such certain relief in so distressing a complaint.

The bare taste and appearance of this water, show that it is a chalybeate. It is strongly characterized by the peculiar astringency and savour of ferruginous impregnations. The reservoirs which receive it have need of being frequently cleansed of a yellow ochreish deposit left there, in considerable quantity, by the running of the spring. The water, though remarkably clear when first taken, becomes turbid upon standing for some time in the open air, and, after a longer interval, an iridescent pellicle forms on its surface, similar to what happens, in like circumstances, to other chalybeates. Ochre and other indications of iron, are dispersed extensively through the surrounding rocks and soil. Iron ore is so plentiful in the vicinity, that furnaces are in operation, both in the eastern and western districts of the chain, of which this mountain forms part, and much of the ore is magnetical. Lime stone is found at the base of the hills and along the valleys. The inhabitants burn it for economic purposes.

Our learned associate, professor Mitchill, has given some interesting geological observations on this district, which he visited in 1810.* He represents Schooley's Mountain as the middle region of the transition chain, which extends in a north-easterly and south-

* Vide the valuable Mineralogical Journal of Dr. Bruce, vol. i. p. 70.

westerly direction across the state of New Jersey, from the Highlands of New-York to the Delaware. These heights completely divide the waters of New-Jersey. From their north western slope all their streams descend to the Hudson and the Delaware. From their south-eastern declivity, their currents reach the ocean by Newark and Raritan bays. These elevations have, however, no pretensions to be classed with the Shawangunk Mountains, which are a distinct chain, and make part of the great Alleghany. Schooley's Mountain is of moderate elevation. Geometrical measurement has determined that its height, above its immediate base, is more than six hundred feet; and Dr. Mitchill calculates, by approximation on the falls of water at the different milldams along the hurrying channel of the Musconetcong to its junction with the Delaware, and on the descent thence to Trenton, that the base itself is five hundred feet more above tide-water.*

Rocks are thickly distributed over the face, and along the sides of the mountain. They consist chiefly of feldspar and quartz. Many masses may be examined without observing a vestige of mica, but a little schistus or hornblende is found embodied in its stead.

The mineral spring is found in the town of Washington, in the county of Morris. It is situated in a deep defile, between two beautifully wooded mountains, and issues from the perpendicular side of a steep rock, about forty or fifty feet above the level of a brook that gurgles and foams over a rocky bottom, within a few paces of it. The extremity of a wooden leader is adapted to the cleft in the rock to receive the water, and convey it to the platform where the drinkers assemble; and to recesses, whither the bathers retire.— The spring discharges a gallon in about two minutes and a half, and the quantity is not observed to vary under any changes of season or weather. Its temperature, at its issue from the rock, was found to be fifty-two degrees of Fahrenheit. I instituted the following preliminary trials in order to obtain some general notion of the substances to be expected from the analysis of this water.

a. Though it seemed superfluous to examine it for iron, yet in order to observe its habitudes with the tests of that metal, prussiate of lime was added to a portion of it fresh from the spring, and tincture of galls to another. The tincture speedily turned it to a fine purple colour, and the prussiate produced a precipitate after a short interval.

b. I boiled a portion of the water, in a glass vessel, down to one half; its transparency was changed, and it assumed a yellowish green colour, such as it acquires by standing a few hours in the open air. After this boiled water had entirely cooled, it no longer gave any indication of iron to the same tests.

* Dr. Mitchill.

e. There was no effect produced by the water from the spring on infusion of litmus, nor on litmus paper.

d. It produced no change in tincture of turmeric, nor in turmeric paper.

e. The addition of concentrated sulphuric acid caused an extrication of air bubbles.

f. Acetite of lead was in no wise discoloured.

g. Oxalate of ammonia gave some precipitate, and, to avoid ambiguity, a portion of ammonia was first added, in order to saturate any acid that might be present, since oxalate of lime is readily soluble in the mineral acids.

h. Muriate of barytes afforded no precipitate in the course of three or four hours. Yet this indication is not decisive.

i. Lime water added in equal parts produced a copious precipitation soluble in nitric acid with effervescence.

k. Nitrate of silver changed the colour of the water to a light opal. The same re-agent indicated that the water of the adjoining brook was remarkably free from muriatic salts.

The ninth experiment, (*i.*) especially in the quantity in which the hydrate of lime was employed, shows that the mineral water of Schooley's Mountain contains carbonic acid. When this test is mixed only in small proportion with water holding carbonic acid, the result is apt to be fallacious, as the excess of acid re-dissolves the lime. The super-carbonate of lime will remain in solution when a sub-carbonate would fall to the bottom. By the experiments (*i.*) and (*k.*) it is seen that carbonic acid is the solvent of the iron. The connexion between this result and the constitution of the mountain, is also striking. The mountain abounds in magnetic iron ore, and it is in this state that a carbonated water can take up most of the metal. The water is perfectly clear when fresh from the spring, but soon grows turbid by exposure to the air, and gradually deposits a fine ochre. A part also swims on the surface in the form of a thin shining pellicle. After it falls to the bottom, the presence of iron is no longer indicated, by the most delicate tests. These effects are proofs of its being a carbonated chalybeate; for the turbidness by the precipitation of ochre and the pellicle, do not take place until the carbonic acid has flown off, whether separated spontaneously, or expelled by heat.

A water holding sulphate of iron deposits an ochre by absorption of oxygen; but if it contain a carbonate of iron, the precipitate is owing to the separation of carbonic acid. The carbonated chalybeates are by far the most numerous; indeed, any others are extremely rare.

It would appear by (*c.*) that the water from the spring does not contain a free acid; but the just inference, with regard to the absence of carbonic acid, is, that the water does not contain the one eighteenth of its bulk of carbonic acid gas, that amount being necessary to produce the effect of reddening litmus paper.

It appears by (*d.*) that there was not present a free nor carbonated alkali, nor a pure earth.

(*e.*) Showed the separation of some gaseous substance; other trials determined it to be carbonic gas.

(*f.*) Proves the absence of every thing sulphurous.

The result of (*g.*) clearly indicated the presence of lime.

(*h.*) Seemed to exclude the presence of sulphuric acid, but sulphate of lime, when present in only a very small proportion, is not detected, with certainty, by any single test; and through the subsequent analysis by evaporation, that substance was found to be contained in this water.

(*i.*) Left no doubt of the presence of muriatic acid.

Were it enough merely to determine the quality of this water, and the nature of its ingredients, those trials might be deemed almost sufficient; but no chymical investigation will now be received as satisfactory, which does not exhibit the exact quantity and proportion of all the constituents of a compound. To do this, further experiments were necessary; and if in the detail of these I shall appear to bestow on small matters a disproportionate attention, it will be recollected that exactness is indispensable. Should any error occur in my process, by being minute, I furnish the greater facility of detecting it to those who may be desirous of re-examining the same subject; and the mode I adopt must be preferable, with the generality of persons, to a bare statement of results, without any view of the successive steps by which they were obtained.

ANALYTICAL EXAMINATION.

THE gentleman, whose case follows, while residing at Schooley's Mountain, evaporated, at my request, a portion of the water according to directions I left with him for that purpose, and transmitted to me, as the residue, a brown, light powder, which weighed 16.50 grains. I subsequently procured a few bottles of the fresh water, carefully filled and corked at the spring, and tied over with wet bladder, from which I determined the proportions of its gaseous and solid contents.

Examination of the gaseous constituent part.

The water, as it issues from the rock, is no wise sparkling, it has no pungency, and manifestly holds whatever gas it contains, in a state of combination. Being forced for the purpose of examining it to use a water cistern, I heated this to one hundred and thirty degrees of Fahrenheit's thermometer, and separating, as atmospheric air, an amount equal to the capacity of that portion of the retort unoccupied by the fluid, I obtained from fifty-seven cubic inches of the mineral water, nineteen cubic inches, nearly, of a gas, the whole of which was absorbed by lime water; so that the mineral water yielded a little more than one third of its bulk of carbonic acid gas.

Examination of the fixed Constituent parts.

Seventy-four ounce measures slowly evaporated in a water bath, left a brownish extract of 4.10 grs. This gives 7.09 grs. only to the gallon. The proportion of foreign ingredients to the simple element, is, therefore, remarkably small in this mineral water. With the 16.50 grs. sent me I made the following experiments:—

1. I poured over the whole between two and three fluid ounces of alcohol of the sp. gr. .847 in a close phial, and shook it repeatedly during twenty-four hours. The solvent acquired a pretty deep brown tinge, and took up 4.10.

2. The remaining 12.40 grs. were treated with three fluid ounces of cold distilled water, and shaken frequently during twelve hours. The water was coloured brown, and left an extract on the filter, that, after being thoroughly dried by the heat of boiling water, weighed 4.50 grains.

3. The residue of 7.90 was boiled in 5,000 grs. of distilled water, by which it was diminished 0.65 of a gr. which must have been sulphate of lime. This third solution was still of a pale brown colour, even after the separation of the selenite. All the solutions were kept separate, and the extracts dried, except in one instance, by the heat of boiling water.

Examination of the Solution by Alcohol.

4. A little of the alcoholic solution was tried in a tube the eighth of an inch in diameter, with tincture of galls, as from its brown colour it might possibly contain highly oxidized sulphate of iron; but no trace was discovered of such an impregnation. The rest was slowly evaporated in a water bath. Its colour turned to a deep brown, and it dried but imperfectly, although the bath was made to boil toward the last. In consequence I washed it out with alcohol, transferred it into a platinum crucible, and evaporated it over the lamp. When perfectly dry its colour was black, and it was found to have lost 0.82 gr. of its weight. The brown colour of the residuum, and which tinged more or less every solution, as well as the facility with which it was charred and partly consumed, showed that it contained a considerable portion of vegetable extract. It could scarcely be otherwise with a water that strains through the decayed leaves and ligneous remains of a primeval forest.

5. This residue, on being treated with a little alcohol, left 0.40 gr. of muriate of soda, to which we should add 0.03 of a grain, water of crystallization, for the state in which the muriate of soda exists in the spring.

6. To the remaining 2.85, of the alcoholic extract, there were added a few drops of concentrated sulphuric acid, which immediately occasioned a brisk effervescence, and by putting the crucible with its contents over the lamp, white vapours of muriatic acid were copiously disengaged. The crucible was lastly brought to a red heat to drive off any portion of uncombined sulphuric acid.

The crucible was then washed out with distilled water, and the sulphates were thrown upon a filter. There passed a solution of a bitterish taste, and a portion was retained, upon which distilled water was continually dropped until it came off tasteless. The part retained was next boiled with carbonate of potassa, and filtered; sulphate of potassa passed the filter, and carbonate of lime remained upon it, the whole of which readily dissolved in muriatic acid, and weighed, when dry, 2.35 grains. The bitterish solution was in like manner decomposed by carbonate of potassa, and re-dissolved in muriatic acid. It yielded of muriate of magnesia half a grain. In this manner these two salts were separated from each other, and the amount of each determined as it exists in the mineral water.

Examination of the Solution by cold distilled Water.

7. This was evaporated slowly in a temperature not exceeding eighty degrees of Fahrenheit. No pellicle or crystal formed on its surface; its taste was insipid to the last. The extract was nearly all soluble in dilute muriatic acid. What the acid left, after being washed, was taken up by alcohol, and amounted to 0.10 gr. of extractive.

To the muriatic solution, ammonia was added until it tasted alkaline; no change appearing, the mixture was heated, but it still remained clear, and gave no sign of magnesia. On trying it, however, with oxalate of ammonia, there ensued an immediate precipitate. Consequently the substance dissolved by the muriatic acid was carbonate of lime, and its amount was equal to 4.40 gis.

Examination of the Solution by Acetic Acid.

8. The residuum, insoluble in alcohol and water, was digested in distilled vinegar for twelve hours, and occasionally shaken. A little being tested in the small tube with oxalate of ammonia, it was found to hold lime, and another small portion being tried with caustic ammonia, the presence of magnesia was also proved. But these earths must have previously existed in the state of carbonates.

The acetous solution evaporated to dryness, gave a whiter extract than any yet obtained. By remaining exposed to the air all night, it attracted a little moisture, corroborative of its containing acetite of magnesia. The evaporated solution weighed 6.35 grains. It dissolved in cold distilled water, with the exception of a minute brown sediment which dried in the water bath, weighed 0.05 of a grain. It seemed to be muriate of lime, for it was not affected by muriatic acid, but touched with concentrated sulphuric acid, it effervesced, and there remained a white smooth residue which was manifestly sulphate of lime formed in the experiment.

To the aqueous solution of the acetate, there was added ammonia in excess, which occasioned a precipitate of magnesia: washed and dried, it weighed 0.10 gr. Now, as in 100 parts of acetate of magnesia there are 34.04 of base,* we have this proportion; as 34.04 : 100 :: .10 : .29, which subtracted from 6.35 gives .29 acetate of magnesia, and 6.06 acetate of lime. Again, to find the base appertaining to this acetate 6.06; say as 100 is to 34.25, the proportion of base in 100 parts acetate of lime, 6.06 to its base 2.08.† But it is necessary to re-convert these acetates into carbonates, in which state they existed in the mineral water, and as in carbonate of magnesia the base is twenty-five per cent. we have .25 : 100 :: .10 : .40.‡ And as the base in carbonate of lime may be stated at fifty-eight per cent. we have 58 : 100 :: 2.08 : 3.586; or say 3.59. Thus we find the two carbonates, that of magnesia = .40, and that of lime 3.59, both = 3.99 grains.

Examination of the Solution of Muriatic Acid.

9. Dilute muriatic acid, digested on the residuum left in the last experiment, dissolved a portion, and a dark muddy sediment remained

*Thompson, vol. 3, p. 63, 4th ed. †Do. do. p. 64. ‡Do. vol. 2, p. 650.

of a gritty feel. When collected and ignited on the filter it afforded 0.80 of silex.

To the filtered solution ammonia was added, until it tasted alkaline. A brown precipitate ensued, which, collected and ignited, left 1.40 oxide of iron attracted by the magnet; or say 2 grains carbonated oxide of iron, such as it exists in the water. The solution itself was then evaporated to dryness, and as no deliquescence appeared in the course of twelve hours, it was concluded that no alumine is contained in these waters.

SUMMARY.

Extractive	by exp. 4).....0.82 }	}	= 0.92
	7).....0.10 }		
Muriate of Soda	.....		0.43
Muriate of Lime	4).....2.35 }	}	= 2.40
	8).....0.05 }		
Muriate of Magnesia	.....		0.50
Carbonate of Lime	7).....4.40 }	}	= 7.99
	8).....3.59 }		
Sulphate of Lime	.....		0.65
Carbonate of Magnesia	.....		0.40
Silex	.....		0.80
Carbonated Oxide of Iron	.....		2.00
Loss	.....		0.41
			16.50

Remarks on the Medical operation of the preceding Water.

The benefit which the mineral water of Schooley's Mountain afforded repeatedly to Mr. H*****, of this city, has contributed, most of any instance within my knowledge, to establish its efficacy, and raise its reputation. The resources it affords to medicine cannot, therefore, be better illustrated, nor these observations more properly concluded, than by a relation of his case.

Mr. H. laid the foundation of the early eminence to which he has arrived in the profession of the law, to a course of such severe and unremitting study, while a student of Columbia College, as none in that seminary were tempted to exceed; and such, indeed, as no literary or professional distinctions, fascinating as are these objects, can require any body for acquiring at the same cost of excruciating disease. From the age of sixteen he led a remarkably studious and sedentary life, scarcely ever sparing himself time to exercise; and this train of close application to books, and these long sittings at the desk, may altogether have filled a period of ten or a dozen years, before the disorder they brought upon him was entirely formed.

Early in the year 1809 he began to feel, when lying down, a sensation of heat in the region of the kidneys. It continued so for some months, was by no means painful, gave no alarm, and barely excited attention. But, in the course of the summer of that year, it increased so far as occasionally to make him restless in bed, without being so troublesome as to cause him to mention it to his physician. At

last, one night, toward the beginning of autumn, he was attacked, a few hours before day, by a most excruciating pain in the small of the back. Finding himself almost unable to endure it, he sent for his physician, the late Dr. P. who, among other things, directed fomentations to be applied to the part. After suffering, as the patient then thought, most severely for several hours, the pain suddenly subsided; the relief was as unexpected as the attack, but it left him extremely languid.

A few days afterward the pain seized him again in the same place, and lasted many hours. Dr. P. then first expressed his apprehension that the disorder was gravel in the kidney. He opened a vein to relieve the present symptoms, took away blood freely, and by these means procured immediate ease. It was followed by the discharge of a little blood and some gravel along with the urine.

For several succeeding months, attacks of the complaint came on at intervals, and always with extreme pain. Lime water was now prescribed, and taken freely for a great length of time, during which course the patient discharged occasionally fine gravel, and once, after severe exercise, in considerable quantity mixed with blood.

In the winter of 1812—13, his disorder had reached an alarming height. He had fits of it every two or three days, and sometimes twice a day. The paroxysms were in general so violent, that he involuntarily writhed in the utmost torture while they lasted. The pain had always its seat in the region of the kidneys, sometimes on one, at other times on both sides. With his worst attacks there was a total suppression of urine for twenty-four, or even forty-eight hours, without any fullness of the bladder, or inconvenience felt in that organ; but at those times a cutting sensation was experienced along the course of the ureter, as if an angular grain of sand descended through that passage. Almost invariably before being seized with a fit, he found it impossible to pass water, though strongly solicited, or, at most, could pass but a few drops, and that with extreme pain. Shortly after any attack subsided the urine came off very freely.

He was always conscious of the passing of the irritating matter into the bladder. That instant the pain ceased, and shortly afterward the urine flowed without interruption. It was then frequently tinged with blood, and always more or less charged with sabulous matter. Most part of this season was passed in such suffering: medicine afforded no relief, and was abandoned: a temporary ease was sought for in blood-letting during the paroxysm, and the almost daily use of the hot bath, heated to a degree barely tolerable. The least inconvenience of such palliatives was to leave the patient exceedingly debilitated.

During all this period, the use of acids was carefully avoided: but finding the return of the paroxysms so very frequent, and experiencing no advantage that could be ascribed to lime water, the attending physician determined upon trying the effect of an opposite plan, and directed cider for the patient's drink. This course was likewise

persisted in for a considerable time, though the injurious consequence of it was soon manifest and alarming. The pain was almost ceaseless, and the severer paroxysms occurred now very frequently. Under these circumstances the patient felt greatly discouraged. In him, regular habits and constant temperance seemed bereft of their usual good consequences. He was also free from any hereditary disorder, and naturally of a very robust constitution, without deriving from these things their accustomed advantages. One alleviation only accompanied his sufferings: ever since his nephritic attacks became severe and frequent, he was no longer molested by a periodical head-ach, that had afflicted him from his childhood.

Having been sufficiently admonished, by the aggravation of his complaint, to drop cider, he returned again to the use of lime water, and persevered in it for several months, with as little benefit as it at first. At this time Dr. P., upon consulting with Dr. M., determined to change his medicine for carbonate of soda. He took this also a long while, and conjointly with it drank abundantly of supercarbonated soda water. Nevertheless, his disorder did not, at all, abate by any thing he had yet done.

In the spring of 1813, he was first advised to try the mineral water of Schooley's Mountain, which was then represented to him as beneficial in cases of gravel. He went there in the course of the summer, and remained about three weeks, but did not experience any decided advantage from his first visit. At the end of two weeks his urine appeared all of a sudden quite black, and remained dark coloured for about eight days. He has since found, during several after visits to the spring, that such a change of colour is a favourable symptom. But at that time business hurried him back too soon to the city; it was hoped, however, that magnesia, as yet an untried remedy, might be substituted for the waters, with, at least, equal advantage. The experiment did not answer the expectation; it must, at the same time, be acknowledged, that the magnesia did not get an equally fair trial with other medicines far less promising.

Early in the ensuing summer he again visited Schooley's Mountain. At the time of his arrival there he was extremely feeble, and three or four weeks passed over before he experienced any great mitigation of his principal complaint; but he found his strength and general health gradually to improve. In less than a month his urine began to be discoloured, it soon after became almost black, the waters operated as a powerful diuretic, and gradually his disorder gave way. The moment his strength would permit, by way of ascertaining the progress of his amendment, and from motives of pleasure as well as health, he began to take exercise, particularly on foot, and by labouring in the garden. All this he bore with a sensible and daily increased advantage. After a stay of three months he was able to support fatigue of every kind without inconvenience. He believed himself nearly, if not completely, cured, and in fact continued well for a much longer interval than upon any former occasion,

The quantity which he drank of the water, was from fifteen to twenty half pint tumblers a day. He had taken it at different seasons, and experienced similar effects from it, winter and summer; especially when he joined to its use exercise in the open air. But as wet and tempestuous weather always brought on attacks of his disorder, it was only when he had resided some weeks at the spring that he was ever proof against violent changes in the atmosphere. He finds that the beneficial influence of the water is not permanent, though, indeed, the longer he drinks of it, his intervals of ease are proportionably protracted. When he returns to his professional labours in this city, to late hours of writing and study, and adds to bodily inactivity a great deal of mental exertion, or experiences from any source whatever, much anxiety of mind during the same period, the suspended assaults of his distemper are speedily renewed with no less severity than ever. As those causes must have operated against the beneficial effect of all the medicines he took at any time in town, their insufficiency in his case cannot, in fairness, be considered to detract from the character they may have acquired on other occasions. The patient having convinced himself, at last, that a transition from a sedentary to an active life, was the thing most important, perhaps, to his recovery, he has fixed his residence out of town, where he avails himself of the opportunity of exercise afforded by a garden of considerable extent, and a long walk daily to and from his office. In this rural retreat for bodily exercise, and mental relaxation, and from which all books and papers are scrupulously excluded, Mr. H. drinks ad libitum, of a carbonated chalybeate which I directed to be prepared for him. It is made in a strong iron bound vessel containing several gallons of pure water, into which there are introduced a few coils of clean iron wire. Carbonic acid gas is then propelled through the water by means of a forcing pump, after the manner employed in the manufacture of soda water. This artificial chalybeate contains, it is true, much more carbonic acid gas than the natural chalybeate of Schooley's Mountain. The difference, however, renders the artificial more palatable, and to him not less efficacious, than the natural water. It has already produced the same sensible effects. It equally blackened the urine, increased its quantity, and in other respects the patient experienced the same relief from it as from the water of the spring.

It will be remarked, that when Mr. H. first visited the spring, he was there three weeks without experiencing any material alleviation of his disorder; the cause of which seems to be, that he was then too weak to go much abroad, so as to unite exercise with the use of the water, and that his stay there was too short. But that sort of change had already commenced, which many subsequent instances showed to be immediate precursors of a solution of the existing morbid state. It appears, from the history of the case, that collections of sabulous matter take place in the patient's kidneys during any considerable interruption of the chalybeate, especially if, at the same time, he ap-

plies himself closely to his professional avocations. It is equally established, that the chalybeate acts upon the sabulous matter; for this is, at length, evacuated along with the urine which it blackens, and the dark colour, as well as the discharge of sand, continues more or less, according as the previous disuse of the water has been longer or shorter. If, after this, the mineral water be persevered in, it prevents the formation of any new concretions, for the discharge of the dark sediment ceases, the urine returns to its natural colour, and there is no new nephritic symptom.

Such is the course invariably experienced by the patient at the spring, where air and exercise, and a vacant mind go hand in hand, with the drinking of the chalybeate: but in the city, where, in spite of the physician's remonstrances, profitable business occasionally forces him to longer sittings, greater application, and stronger exertions than are compatible with the delicacy of his health, he still has an attack at distant intervals, though comparatively so slight, that it scarcely deters him from the indulgence of books and study. A speech of two or three hours in court, or any vehement affection of mind, will bring on a paroxysm as readily as would a thorough wetting, or a fortnight's confinement.

This seems to be one of those cases that proves the superior efficacy of air and exercise, and moral treatment, in a chronic disease, to any other remedy whatever. Even the salutary effects of that medicine which proved most beneficial, must appear to have been derived, in a very subordinate degree, from its purely medical qualities. I administered carbonate of iron, combined with large dilution, to the patient, during his sedentary period, without warding off, or apparently mitigating his complaint; but, at this very interval, a visit to his father's farm on Long-Island, and leading there a farmer's life for some weeks, was followed by a remission of his disorder. Nevertheless, to the iron contained in the Schooley's Mountain water, must be ascribed some portion of the relief procured. When the chalybeate is drank for some days after the worst attacks, it evidently effects a change in the state of the kidneys, and in particular, appears to find there, and to combine with, a portion of sulphur, with which it forms a sulphuret, distinguishable by its black colour. This unusual quantity of sulphur in the urine seems to be connected with the morbid condition of the kidneys, for its evacuation is a sure precursor of amendment, and during the further continuance of the water, the accumulation of gravel and sulphur is, if not altogether, at least very much lessened.

The calculous affection of this patient was constantly aggravated by acescent food and acid drinks, and therefore appears to be owing to a deposition of uric acid, which admits of being precipitated within the body by the superior affinity of a stronger acid for its base. One cause, undoubtedly, of his being better of late, is the careful avoidance of every acid drink.

Another property of the Schooley's Mountain water is, that the

carbonic acid it holds is altogether in a state of combination, and this accounts for its never occasioning flatulence, or spasm, in the weakest stomach, at the same time that it gradually strengthens the digestive powers like other chalybeates. The mineral waters of Vichy, in France, are a hot chalybeate, and do excellent service in nephritic complaints. The waters of Cheltenham and Scarborough, in England, in addition to iron, contain a considerable portion of sulphate of soda, which helps to render them diuretic, as well as purgative, and eminently serviceable in dyspepsia. I have also combined occasionally with the artificial chalybeate prepared for Mr. H. a dose of Glauber. A half tumbler of the solution of this salt, is filled up from the fountain containing the chalybeate: by the use of this he has the advantage of increasing the quantity of urine, correcting the habitual tendency to costiveness, and increasing, upon the whole, the good effects of the water.

Owing to a variety of provoking accidents, I have not been able, as yet, to make any analysis of the matter discharged; frequently, what had been collected for a few days, at my earnest solicitation, was all thrown away, through the effect of a preposterous cleanliness, or an incurious neglect.

New-York, July, 1815.

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