

An analysis of the medicinal waters of Llandrindod in Radnorshire, South Wales : with observations upon the diseases to which they are applicable, and directions for their use : to which is prefixed a topographical account of the place / by Richard Williams.

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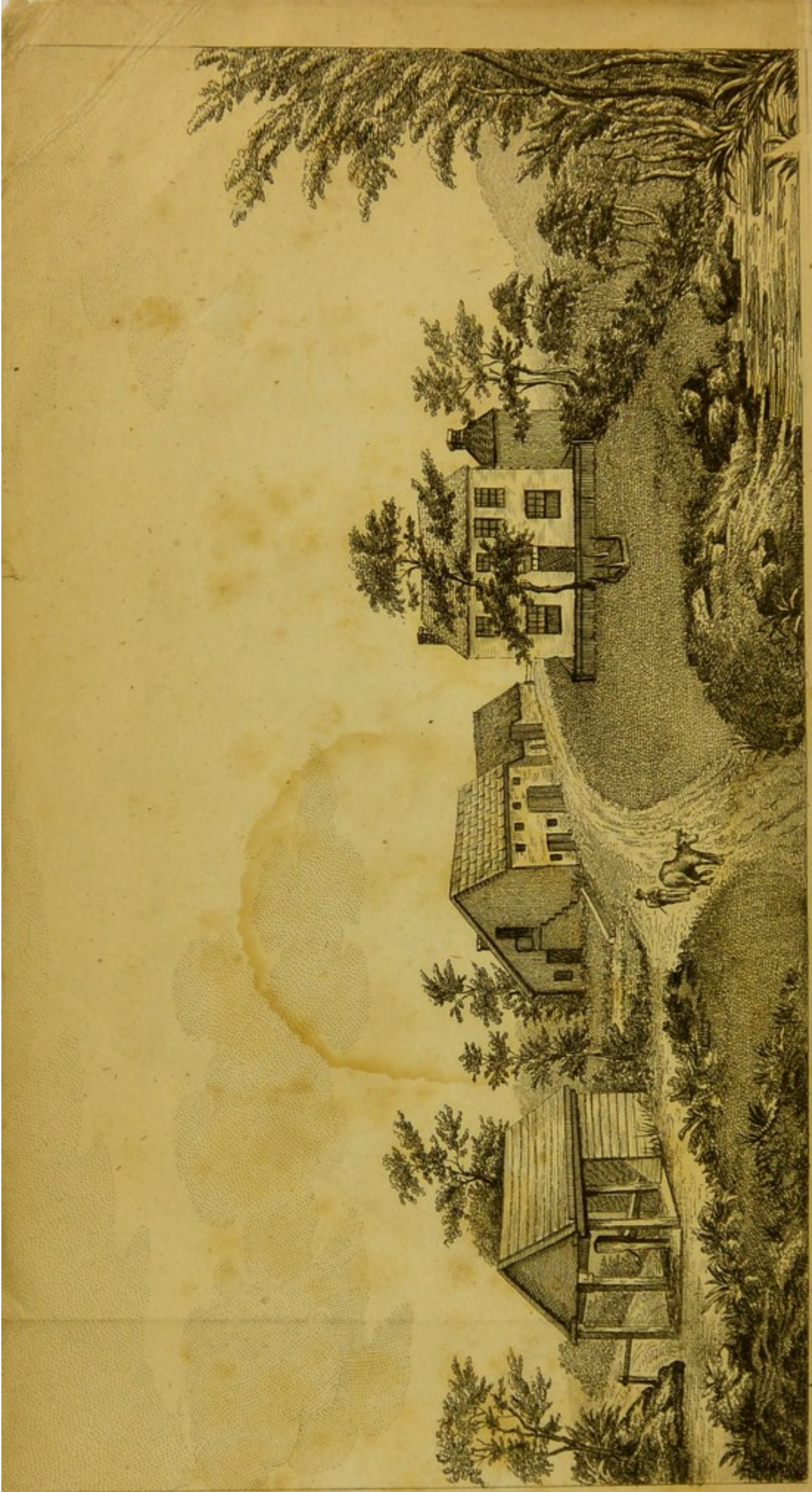
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BRISTOL ROYAL INFIRMARY.

AN

ANALYSIS

OF THE

MEDICINAL WATERS

OF

Llandrindod,

IN

RADNORSHIRE, SOUTH WALES;

WITH OBSERVATIONS UPON THE DISEASES TO WHICH THEY ARE
APPLICABLE, AND DIRECTIONS FOR THEIR USE.

TO WHICH IS PREFIXED

A TOPOGRAPHICAL ACCOUNT OF THE PLACE.

BY RICHARD WILLIAMS,

SURGEON,

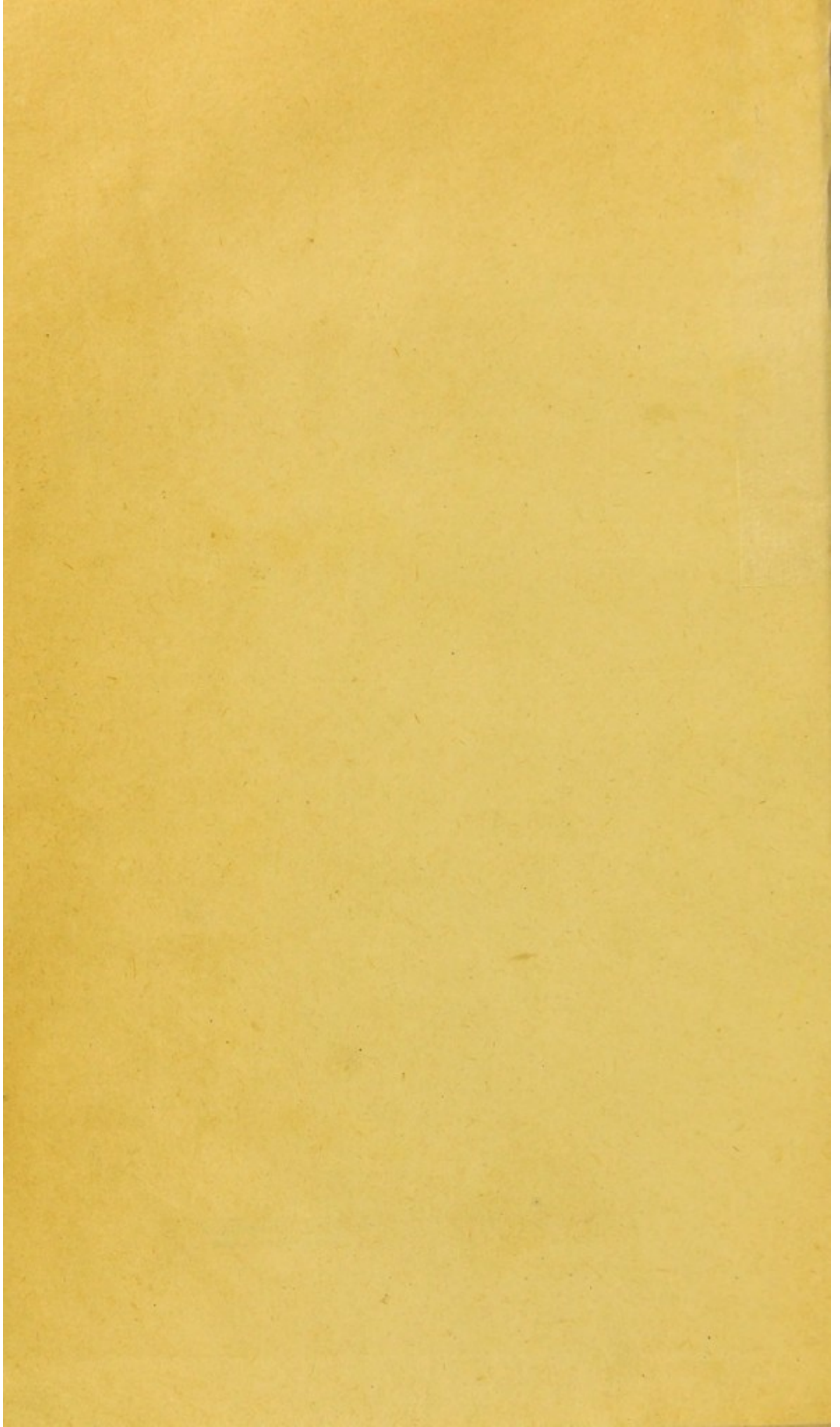
Honorary Member of the Physical Society of Guy's Hospital, London.

"Scire potestates Aquarum, usumque bibendi." VIRGIL.

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1817.



TO
HER ROYAL HIGHNESS
THE PRINCESS CHARLOTTE

OF
Wales and Saxe-Coburg.

MADAM,

YOUR Royal Highness having graciously condescended to allow me the high Honor of dedicating this Analysis of the Medicinal Waters of Llandrindod to your Royal Highness, I most thankfully avail myself of that Permission.

The following Pages have been written with a View to benefit the afflicted, by making these Waters, and their peculiar Properties, more generally known.

No Account of them has been published

since the Year 1756; at which time, your Royal Highness's august Ancestor, the late Princess Dowager of Wales, was pleased to patronise the Treatise of Dr. Linden.

Availing myself of your Royal Highness's well-known Disposition to promote the Happiness and Prosperity of the People of these Realms, I present to the Public, under the Sanction of your illustrious Name and Character, this, my first Essay, which has their Health for its Object; hoping that it will serve the Purpose for which it was written, and that it will not prove altogether unacceptable to your Royal Highness,

I am,

With every Feeling of the most profound Respect,

Your Royal Highness's

Most Humble and devoted Servant,

RICHARD WILLIAMS.

Aberystwyth, August 20, 1817.

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INTRODUCTION.

HAVING often heard of the efficacy of the waters of Llandrindod, in the cure of many diseases, and sixty-one years having elapsed since any analysis of them was presented to the public, I resolved to investigate their peculiar qualities. The results of my inquiries, stated in the following pamphlet, may contain some observations respecting them which have not been hitherto published ; especially as the former Treatise was written at a period when chemistry was in its infancy, and the proper means of discovering the nature of mineral waters were not sufficiently known.

During the time I was thus occupied at Llandrindod, I collected several particulars relative to the place, which have been prefixed to the chemical history of the waters, and hope they will not be found uninteresting to the reader.

Its antiquities and vestiges of war have been but little noticed by tourists and topographical writers,

and may at least amuse the curious visitor ; some account also of the climate, soil, and mineralogy of the surrounding country may be expected in the course of my dissertation.

The importance of water in the preservation of life, and the influence which it constantly exercises in the animal and vegetable kingdoms, could not fail to attract the attention of the older philosophers ; but as they had no methods of judging of its component parts but by its sensible properties, water was for ages considered as an elementary substance, capable of dissolving and holding in solution various saline and earthy bodies.

Among some nations, a sort of veneration exists for particular waters ; thus the Ganges is not only esteemed by the Indians for the depth and pureness of its stream, but for a sanctity which they believe to be in its waters. It is visited annually by several hundred thousand pilgrims, who pay their devotion to the river as to a god : they carry their dying friends from distant countries to expire on its banks, and to be buried in its streams*.

* Goldsmith's Natural History, vol. i.

Pliny mentions a variety of waters remarkable for conspicuous physical properties, which, with their having accidentally produced beneficial effects on the health of those who made use of them, was probably the first cause that occasioned them to be distinguished from common waters.

* In the fifteenth century physicians began to make more curious inquiries into the qualities of mineral waters, those of the hot kind particularly, and they have delivered down to us several observations concerning the virtues and the uses of them. Among these, Michael Savonarola distinguished himself, and improving upon what Foh de Dondis and Ugolinus de Monte Canino, had already published, he wrote a Treatise upon all the baths which were then known in Italy.

† In 1562, William Turner wrote a Treatise on the Bath waters, and observes, that although they had been used in the neighbourhood for above a thousand years, no account of them had ever been published, and that they were not much known in

* Friend's History of Physick.

† Rare Treasure of English Baths.

the north of England at that time ; he supposed them to be impregnated with sulphur, and has given directions for their use.

* In 1667 Duclos engaged in an examination of the different mineral waters of France. In 1685 Boyle, after having made various experiments on the powers of re-agents, published a work on the subject, which in 1729 was greatly improved by Bouldoc.

In 1755 the acid properties of fixed air were discovered by Dr. Black, and about thirty years afterwards Mr. Lavoisier ascertained its constituent principles to be carbon and oxygen. Previous to this discovery, the alchymists, who had entertained the most vague and unsatisfactory ideas of its nature, concluded, that its deleterious qualities proceeded from mercury or arsenic.

Van Helmont, who had noticed the formation of this gas during the process of fermentation, gave it the name of gas sylvestre ; and a " volatile vitrioline

* Fourcroy's Chemistry, Vol. IV.

acid" was believed to be the only natural solvent of ferruginous substances until the existence of carbonic acid was detected in mineral waters by Dr. Priestley.

In 1781 Mr. Cavendish, after repeating the experiments of Mr. Waltire and Dr. Priestley, succeeded in the decomposition of water, and found that it consisted of oxygen and hydrogen gases, in different proportions; which was acceded to by Mr. Lavoisier in 1783, and has been fully confirmed by succeeding chemists.

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 different proportions; which was needed to try
 Mr. Lavoisier in 1788, and has been fully confirmed
 by succeeding chemists.

The next experiment was made by Mr. Cavendish
 in 1784, who found that the gas which he had
 called hydrogen, was composed of two parts of
 hydrogen and one part of oxygen, and that it
 was the same as the gas which he had called
 inflammable air.

It was also found that the gas which he had
 called hydrogen, was composed of two parts of
 hydrogen and one part of oxygen, and that it
 was the same as the gas which he had called
 inflammable air.

A TOPOGRAPHICAL ACCOUNT

OF

Llandrindod*.

LLANDRINDOD, or Llan y Drindod, is a Welsh name, which in English signifies the Church of the Trinity. It is a curacy, not in charge under the Prebend, in the Cwmwd of Is Mynwyd, Cantref of Elfel (now called the hundred of Cefn Llys), in the county of Radnor, South Wales, of the certified value of 6*l.* and in the patronage of John Dale, Esq.

According to the Diocesan Report in 1809, the yearly value of this benefice, arising from the augmentation and fixed stipend, was 35*l.* 1*s.*

The Prebend of Llandrindod is valued in the King's books, at 5*l.* 8*s.* 9*d.* and is in the patronage of the Bishop of St. David's.

Llandrindod is situated seven miles north-east of Builth, eight miles south-east from Rhayader, fifteen

* Mr. Capper has omitted to mention this parish in his Topographical Dictionary.

from New Radnor, where there are extensive lime works, and forty miles from Aberystwyth, which is the nearest sea-port town.

Llandrindod church is situated 52.17 north latitude, 3.43 west longitude.

The parish contains 2884 statute acres of land, of which about 1500 acres are enclosed, and the remaining 1384 not enclosed.

In 1801 the population of Llandrindod amounted to 192 persons. The number of inhabitants now * residing in the parish, is estimated at 180; 87 males, and 93 females. From the commencement of the year 1800 to the close of 1816, there had been 66 births, 37 males, 29 females; and during the same term of years, 46 deaths, 26 males, 20 females.

In 1803 the money raised by the parish rates amounted to about 127*l.* at 3*s.* 9*d.* in the pound.

It cannot be ascertained whether Llandrindod was formerly a portion of the Roman Siluria, or of one of the other provinces. In the Welsh division it belonged to Powis, and consequently must at that time, together with the hundred of Builth, have formed a part of North Wales; but for a con-

* June, 1817.

siderable period before and after the conquest, Builth, and the lands between the Wye and Severn, formed an independent territory, possessed by the tribe of Elistan Glodrydd, and called the territory of Ferleg, until it was gradually subdued by the Earls of March, from whom, in the reign of Henry the Sixth, it became vested in the crown.

There are several ruins and ancient fortifications in the vicinity of Llandrindod; of these the most remarkable are, the Great Camp at Cwm Radnor, which has been mentioned by Mr. Strange, on the property of John Williams, Esq., in the parish of Llanfihangel Helegen. Its Roman name is not known, but it is now called Castell Collwyn, from the hazel-brake with which it is overgrown. It is a square enclosure containing one hundred and twenty yards, surrounded by a wall built of hammered or rough hewn stone. The pretorium is very visible, and within it may be traced the remains of partition walls.

The camp is guarded on the west side by a double trench. It is situated upon an eminence on the west bank of the Eithon, about a mile and a half from Llandrindod, and commands a fine view of the country.

From this station there evidently appears to have

been a Roman road towards Brecknockshire. It crosses a ford in the river Eithon, near Caebach, and takes a straight direction southward over the common, passing partly through the fish pond at Llanerchidirion, in a direct line over the other commons towards the cultivated lands, and seems to have crossed the Wye, in the neighbourhood of Llechrhyd Castle; which, from its square and regular form, its contiguity to the Roman Road, its distance from Cwm, and the total absence of any feature characteristic of the British or Norman style, was no doubt of Roman origin.

Many small camps are scattered over the commons, and have been described by the Rev. Thomas Price of Llangurig. They appear to have been placed at irregular distances along the line of the Roman Road, and might have been used as *campi æstivi*; but from their unequal disposition they could not have formed one military alignment, and must have been placed wherever it suited the convenience of the soldiers who may have been employed here in making the road, or clearing the country; and as they would have contained, had they been all occupied at once, at least two or three legions, it is probable that some were deserted, and new ones formed further on, according to the progress made by the

workmen; for they do not deviate much from the straight line, except for the purpose of gaining the high ground, and perhaps they continued for several miles, but have been demolished by the cultivation of the country and the growth of trees, as the road itself has disappeared.

These camps are eighteen in number, and extend upwards of a mile and a half: some are not more than sixteen paces distant, and others three or four hundred. Each camp or station is square, with obtuse angles, and generally from twenty to thirty yards within the agger; with four entrances, one on each side, and opposite to each entrance is a mound; the agger is five or six yards thick, formed of earth, and sometimes a few stones, but nothing like a wall; surrounded by a small trench, from which it was thrown up, except at the entrances, where both are discontinued. It is very low in all of them, and not more than two feet high in the most perfect; and some are so obscured by time, that I have frequently walked over without observing them.

Cefn Llys, or the Court-house hill, is the remains of a British fortress, strongly fortified by nature, being nearly surrounded by the river Eithon, on the lofty banks of which it stands. Its demolition has been so complete, that nothing beyond its mere site

is to be distinguished. Camden mentions it as in ruins when he wrote, about the year 1585. On the north side it lies open to a large and dreary common. This castle was once, together with the lordship of Melienedd, the property of the Mortimers, Earls of March, having been erected by one of that family, and with the exception of occasional interruptions by the Welsh princes, and attainder for rebellion, it continued in their possession till the time of Henry the Sixth, when Edmund, the last Mortimer, Earl of March, died; it then devolved to his brother-in-law, Richard, Earl of Cambridge, and upon his attainder it became again vested in the crown.

Some years ago a silver thumb ring, bearing this impression,



was dug up in a place called the Castle Garden. Many have supposed it to be the signet ring of one of the Princes of South Wales who resided at Cefn Llys; it is now in the possession of Mrs. Edwards of Greenfields, a lady, to whom Llan-drindod owes much for its present celebrity.

The foundations of a very ancient chapel, called Llan Faelon, were lately dug up in the middle of

a corn field at Llandrindod; but scarcely any account of it remains beyond the name.

Upon the common there are two druidical stones, at some distance from each other, and several tumuli, five of which are placed close together. These have been opened, and were found to contain human bones, and pieces of half-burnt charcoal, covered with a heap of loose stones.

* “The custom of consuming the bodies of the deceased by fire, and preserving the ashes in an urn, is one of very ancient date. It was in use with the most polished nations, with the Greeks and with the Romans, as well as with the most barbarous. The ancient Germans practised this rite, as appears from Tacitus. The Druids observed the same, with the wild addition of burying with the body whatsoever was of use in this life, under the notion that they would be wanted in the next; and in confirmation of this, arms and many singular things of unknown use are to this day discovered beneath the places of ancient sepulture.”

To the east above Llandrindod church, is a very ancient lead mine, which has been worked

* Pennant's Tour through Wales.

as late as the year 1797, but is now deserted, though it is probable that the ore is by no means exhausted. The works might have been suspended in consequence of a gush of water, for an attempt had been made to carry a level under them. The galena or sulphuret of lead may frequently be met with, interspersed with calcareous spar.

The Wells consist of four springs; the Chalybeate, the Saline, the Sulphureous, and the Eye water. The saline and sulphureous waters are situated to the north-east, upon a farm in the occupation of Mr. Whitall.

The chalybeate, or rock water, rises on the common, and immediately below it is the eye water.

This common extends to three more parishes; and is within the crown manor of Cantref Melienedd: it is about four miles long, and half a mile broad, surrounded by the hills of Builth, Brecon, and New Radnor. The elevation of the common has been computed at several hundred feet above the level of the sea; the country is open, wild, and romantic, and the air so remarkably mild, and healthy, and agrees with such delicate constitutions, that Llandrindod has justly been considered as the Welsh Montpellier. As a further proof of the salubrity

of the air, it may be stated, that in thirteen years, two years passed without a single funeral; and that during that period the average number of annual deaths did not amount to three.

How long these waters have been used medicinally cannot now be ascertained. It appears they have been employed time immemorial by the common people, "who resorted to them in great troops during the summer months, and drank the waters upon all occasions."

The saline water was in medical use about the year 1696; it afterwards, as it could not be employed for domestic purposes, lay quite useless until 1736, when the tenant's wife accidentally perceived a light proceeding from the inflammable vapours playing round the spot, and being a superstitious woman, she was induced to make a search, in hopes of finding a treasure; to her great disappointment, she found only a saline water, which, however, amply repaid her trouble; for its virtues becoming more generally known, it was the means of raising herself and family to a state of comparative affluence.

* "The same woman that brought this water

* Dr. Linden.

again into use, was also the discoverer of the sulphureous water; and previous to Dr. Linden's time had been the directress of all the medical spas at Llandrindod, and was well known by the name of Mrs. Jenkins. A daughter of her's had been afflicted about five years with an ulcerated head, brought on by a fever. The mother seeing that the neighbouring sulphureous waters cured similar complaints, caused a search to be made for one nearer home. Her endeavours were requited with the discovery, and the discovery with the success she expected; for she not only cured her own child, but did a great deal of good to others."

The eye water differs considerably from the others, in containing sulphuric acid in a combined state. The existence of this well was not known to Dr. Linden. It was brought into notice by a blacksmith, who was accidentally cured of an ophthalmia, by washing his eyes with the water; hence it is sometimes called the Ffynon cwm y Gôv, or the Blacksmith's Well.

In October, 1748, the following description of Llandrindod Wells, in Radnorshire, appeared in the Gentleman's Magazine :

NATURE'S PHARMACOPEIUM.

Let England boast Bath's crowded springs,
Llandrindod happier Cambria sings,
A greater, though a modern name
By merit rising into fame.

Let chemists bid the furnace glow,
Their panacea to bestow ;
To sickness by the search betray'd,
While art denies the promis'd aid ;
To Nature's kinder pow'r I trust,
To Nature ever kind and just ;
To her Llandrindod I repair,
And find a panacea there :
Blest spring ! where pale disease may quaff
New life till spleen and vapours laugh,
Till palsied nerves their tone resume,
And age regains its faded bloom :
Of half the pains that life endures
Sad source, a cold, this water cures ;
No more to naus'ous drugs apply,
Which make it worse to live than die.
Ease first, then health these fountains give,
And make it worth our while to live :
The vein for mirth, the taste for food,
By these continued or renew'd.

Three streams a diff'rent aid bestow,
As sulphur, salts, and minerals flow,

Uniting all that med'cine claims,
And answering Nature's various aims.

"Tis ask'd disdainful, " what can please
In such sequester'd wilds as these?"
If russet heath, or verdant vale,
Or mountains that the skies assail,
Whence pendant woods the steep o'erlook,
And downward tremble in the brook,
If these can charm the wishful eye,
Llandrindod can all these supply.
Would you the bounding steed bestride,
Or, drawn in chaise more idly ride,
No smoother ground can Lansdown* yield
O'er all her spacious, level field;
The river† guiltless sport affords,
And trout and greylings heap your boards;
The ladies fav'rite balls are here,
Here sportsmen chase the fallow deer;
And ———'s‡ board with dainties grac'd,
Might tire the glutton's tutor'd taste;
But ———'s‡ are richer far,
How poor without it dainties are!
" Enough," methinks, the studious say,
" Enough for fragile mortal clay."

* Near Bath.

† The Eithon.

‡ Persons who keep houses of entertainment.

In 1749, Mr. William Grosvenor, of Shrewsbury, "took leases of several houses, and at a considerable expence not only repaired and fitted them up, but also erected additional buildings, particularly one which was large enough to contain several hundred visitors, in which he was assisted by his brother-in-law, Mr. Ingol:" here were then accommodations for the invalid, as well as amusements for the healthy; regular assemblies, billiard rooms, &c.

In August, 1754, Dr. Diederick Wessel Linden, who had visited most of the medicinal mineral springs in Europe, and was well known as an author, went to Llandrindod, invited thither, he says, "by the fame of these waters, in order to reap the benefits of those good qualities and medicinal virtues with which report had, and as he afterwards found by experience, so deservedly furnished them:" at that time he was afflicted, and had been for several years, with an inveterate scurvy; the complaint had fallen into his hands, where it broke out and ulcerated in a very painful and troublesome degree; he had likewise been injured by noxious mineral damps, contracted by analyzing minerals. After a previous examination of the waters, he fixed upon the saline pump water, and continued its use for about a

month, when he found his disorder cured, to his own unspeakable comfort, and the great surprise of all his friends and acquaintance*.

In return for so great a blessing as the restoration of his health, and to make the healing properties of the waters more extensively useful, he undertook his analysis of them, which was published in 1756, under the title of a "Treatise on the Three Medicinal Mineral Waters at Llandrindod in Radnorshire, with some Remarks on Mineral and Fossil Mixtures in their native Beds and Veins, at least as far as respects their Influence on Water."

"Multùm, diuque desideratum."

Dr. Linden was particularly noticed by the Earl of Halifax. He introduced a means of rendering the Welsh lead malleable and fit for all the purposes of the plumber, which previous to his time had been rejected by the London refiners, on account of its brittleness, and exported in large quantities to China, where it was held in the highest estimation, and wrought into those fine and thin plates with which they line the tea-chests.

The Doctor recommended the following method

* Linden, Preface, p. 4.

of rendering the Welsh lead equal to any other:—

“ Take of

“ Tallow, one pound; bees-wax, half a pound; small wood charcoal, (such as is sold in London to kindle fires) finely powdered, one pound.

“ Melt the tallow and wax on the fire, then add by degrees the charcoal, keeping the mass continually agitated till cold, and reposit for use.

“ Of this mixture take about two or three ounces and rub the inside of the iron vessel in which you intend to fuse your lead, on the top of which when in the state of fusion, throw about the same quantity. This greasy unctuous substance will extend itself over all the surface of the melted metal; the plumbers by this method will be recompensed for their labours; none of the lead will exhale in white fumes, a circumstance which not only causes a consumption of the metal, but also greatly impairs the health of the labourers; nor is the expence large, for six ounces of the above will suffice for four or five hundred weight of metal*.”

Dr. Linden appears to have been well acquainted with the writings of Hoffman, whom he frequently quotes. His work on the Llandrindod waters en-

* Gentleman's Magazine, 1752.

titles him to our respect for his good intentions and laborious researches; but from the improvements that have been made in the science of chemistry, cannot now be considered as possessing the accuracy and merit which have been attached to it. He likewise published

Letters on the Knowledge and Improvement of Mining, 2s. Keith. Feb. 1750.

Three Letters on Mining and Smelting, inscribed to the Right Hon. the Earl of Halifax, 1s. 6d. Aug. 1750.

An Experimental Dissertation on the Nature, Contents, and Virtues of the Hyde Saline Purgings Water, commonly called the Hyde Spa, near Cheltenham, in Gloucestershire. London, 1751.

A Treatise on the Origin, Nature, and Virtues of Chalybeate Waters, Natural Hot Baths, Mineral Waters of England and Germany, 1755.

About the year 1769, Dr. Berkenhout in his "Outlines of the Natural History of Great Britain and Ireland," and Dr. Donald Monro in his "Essay on Mineral Waters," 1770, have very briefly made some remarks on the Analysis of Dr. Linden; but from my inquiries, his appears to have been the only original work which has hitherto been published on the Llandrindod waters.

Mr. Grosvenor's establishment continued open for the reception of visitors until about thirty years ago, when it was gradually deserted, and the company retired to the sea coast. Within these few years Llandrindod has again become a place of fashionable resort, and several other houses have been erected nearer to the Wells, where every comfortable accommodation may be procured.

ANALYSIS

OF THE

Soils and Rocks.

As a subject connected with the Analysis of the waters, I shall first state my experiments upon the soil. It is not my intention to enter into a minute and detailed account of all the different strata in the neighbourhood of Llandrindod, but merely to offer a few remarks upon them, so far as regards the waters. The soil consists of a blue, white, and reddish clay intermixed, and resting upon a slate rock.

1. *Analysis of the Slate Rock.*

The rock from which the chalybeate water issues is of this kind, of a bluish colour, disposed in strata, which are inclined directly downwards to the west. It is soft, and easily pulverized in a stone mortar, decrepitates in the fire, and changes to a dusky red colour; upon exposure to the air and moisture, it crumbles down into a fine powder. It is of the specific gravity 2372, and effervesces strongly with the mineral acids.

A. 1000 grains were boiled in sixteen ounces of

distilled water for thirty minutes, the solution being separated and examined with various re-agents, was found to contain only a slight trace of sulphate of lime.

B. 100 grains were exposed to a red heat for twenty minutes, and lost by weight 5.5 grains, principally water of absorption.

C. 100 grains were boiled for three hours with nitro-muriatic acid diluted with distilled water. The solution gave a white precipitate with muriate of barytes, denoting the presence of a small proportion of sulphur, which had been converted into sulphuric acid during the process.

D. 100 grains were digested with 294 grains of diluted muriatic acid, and the loss of carbonic acid gas being ascertained, amounted to 5 grains.

E. a. 100 grains were digested in acetic acid, which was added until all effervescence ceased; the solution was filtered, and the protoxide of iron which the acid had dissolved, precipitated by prussiate of potash. The solution was afterwards neutralized by crystallized carbonate of potash. The carbonate of lime was deposited, and when dried at 212° , weighed 12 grains.

b. The insoluble matter was boiled for four hours in three times its weight of sulphuric acid diluted

with distilled water; the solution was filtered, and the residue, after being heated red for fifteen minutes, acquired a white colour, and weighed 64 grains.

c. The sulphuric solution was mixed with prussiate of potash; a dark blue precipitate ensued; it was collected, exposed to a red heat for half an hour, and then weighed 9.25 grains.

d. The solution from which the iron had been thrown down, was saturated with carbonate of ammonia; the alumina was separated, and when dried as the former precipitate, weighed 7.5 grains.

e. No magnesia could be detected in either of the solutions.

100 grains of the slate rock, near to the chalybeate water, then contain, of

	<i>Grains.</i>
<i>B.</i> Matter destructible by heat, chiefly water	
of absorption	5.5
<i>E. a.</i> Carbonate of lime or chalk	12
<i>b.</i> Silix, or Flint.....	64
<i>c.</i> Iron.....	9.25
<i>d.</i> Alumina	7.5
	<hr/> 98.25
Loss with a trace of sulphate of lime and sulphur	1.75
	<hr/> 100

2. *Analysis of the Soil upon the Common.*

The surface of the common is covered by a short peat, which is dug up by the peasants for the purposes of fuel; below this is a layer of a dark coloured earth, containing much vegetable matter, which rests on a bed of clay, supported by a schistose rock. To the south there are large masses of the plum-pudding stone. In some places the common is drier and more gravelly than in others, which are wet, and divided by extensive turbaries.

The clay near the rock water is of a reddish colour streaked with white, soft to the touch, insipid to the taste, and intermixed with loose stones and pieces of slate, partially soluble in the mineral acids without effervescence.

A. 400 grains of the clay taken about 20 yards above the spring, and 12 inches below the surface of the ground, were exposed to a gentle heat, until the water of absorption was driven off, and lost 29 grains.

B. The remainder was gently bruised in a mortar, and the loose stones and gravel, separated by a wire sieve, weighed 105 grains.

C. The clay was boiled for half an hour in a pint of distilled water, and the fine schistose sand, divided from the impalpable powder, weighed 46 grains.

The loose stones and sand were soft, and consisted of slate, clay, and iron.

The watery solution being filtered and evaporated to dryness, did not leave any saline residue.

D. The 220 grains of an impalpable powder were digested for twelve hours in cold diluted muriatic acid, the solution was filtered, and the insoluble matter, when washed and dried, weighed 203 grains; after being exposed to a red heat for half an hour, and having its vegetable matter destroyed, it weighed 192 grains.

E. The 192 grains were boiled for two hours and a half in sulphuric acid, diluted with four times its weight of water; the solution was filtered, and the residue, after being well washed with distilled water, and dried, weighed 152 grains.

The muriatic acid had dissolved iron combined with alumina, and a very minute quantity of carbonate of lime.

The sulphuric acid had taken up the iron and aluminous earth which were not soluble in cold diluted muriatic acid. They were precipitated by succinate of ammonia, and when heated to redness, weighed 35.25 grains.

Four hundred grains of the clay, according to this Analysis, which is intended to shew the general

composition of the soil near the rock water, are then composed of

	<i>Grains.</i>
Water of absorption.....	29
Loose stones and gravel	105
Fine gravel and sand	46
Iron, alumina, and a trace of lime...	17
Vegetable matter	11
Peroxide of iron and alumina.....	35.25
Silex, finely divided.....	152
Loss.....	4.75
	<hr/>
Total.....	400
	<hr/>

3. *Analysis of the Soil between the Saline and Sulphureous Waters.*

The soil near the saline and sulphureous waters is deeper than that upon the common. It scarcely effervesces in any perceptible degree with the mineral acids, either concentrated or diluted, indicating the absence of any notable proportion of a calcareous earth; but it feels gritty to the touch, and contains much siliceous matter.

A. 400 grains were exposed to a red heat for half an hour, until the water of absorption and vegetable matter were destroyed, and then weighed 305 grains.

B. The mass was ignited in a crucible with one-third of its bulk of charcoal: it became of a brick-red colour, and was strongly attracted by the magnet. The clay was boiled in six ounces of distilled water for twenty minutes: the solution was filtered, and left in an open dish for some days; but no precipitation of sulphate of lime ensued, neither did any appear to exist in the soil.

C. 400 grains of the clay were dried by a gentle heat, and being suffered to remain in a room of the temperature 56° for twelve hours, were found to have absorbed 4.5 grains of water.

D. 1000 grains were boiled for twenty minutes in a pint of distilled water, but no saline matter could be detected in the water of lixiviation.

E. a. 50 grains of the clay, taken from between the saline and sulphureous waters after it had been heated red for half an hour, were boiled with one drachm of vitriolic acid, diluted with four times its weight of water, to dryness; as some redness remained in the mass, the process was repeated with half the quantity of acid. The whole was diluted with 12 ounces of water, the insoluble matter, separated and dried at a red heat, weighed 32 grains.

b. The solution was rendered of a dark purple

colour by the addition of prussiate of potash, and the sediment which followed, after being ignited, weighed 10 grains.

c. The liquor thus freed from the iron was neutralized by carbonate of ammonia, and the aluminous precipitate which ensued, dried as the former, weighed 8 grains.

d. The neutralized solution being further examined by caustic ammonia, gave no indication of the presence of magnesia.

e. The 32 grains (*E. a.*) of insoluble matter were boiled in distilled water, the solution was filtered, and the sulphate of lime precipitated, and decomposed by carbonate of potash, weighed about 0.25 grain.

50 grains of the clay having been previously heated red, contained, of

	<i>Grains.</i>
Silex or flint.....	31.75
Iron.....	10
Alumina.....	8
Lime.....	—.25
	—
Total.....	50
	—

LLANFAWR ROCK.

This rock lies about half a mile north of the sulphureous water; its specific gravity is 2.29. The stone is exceedingly hard, but may be reduced to powder by making it red hot, and then suddenly plunging it into cold water, it breaks with a smooth fracture, and exhibits a grey or bluish surface, interspersed with dark black spots, and effervesces strongly with the mineral acids, giving out nearly 5 per cent. of carbonic acid gas.

The colour of the rock depends on the iron; and although rendered lighter by digestion in cold diluted muriatic acid, the dark spots cannot be extracted without the assistance of heat, when the silex is left perfectly white.

50 parts of the rock yielded by analysis, of

	<i>Grains.</i>
Carbonate of lime.....	6.5
Iron and alumina	8.25
Silex	35.25
	—
Total.....	50
	—

From the experiments which have been detailed, it is evident that the saline ingredients of the waters

do not exist in the soil, and that the sterility of the common chiefly depends on the want of lime and fine gravel, the proper application of which would render the stiff clay less coherent, and capable of growing farinaceous substances of all descriptions fit for the support of man. Sir Humphry Davy remarks, "that one cause of the unproductiveness of cold adhesive soils is, that the seed becomes coated with matter impermeable to the air; the grain should not, therefore, be buried deeply in the ground, in order that it may have free access to the atmosphere, for the mucilage contained in the cotyledon of the young plant cannot be converted into sugar, which is the nutriment of the young plant, without the absorption of oxygen."

The saline principles most probably lie dispersed through the rock, under a great part of the country; and there is little doubt but the number of waters already known at Llandrindod might be augmented by a careful search. Several springs have been observed in the yard of the Rock-house of a similar nature to those in use: and about three years ago, in sinking a pump at Howey, the seat of James Crummer, Esq. a sulphureous water was discovered, which contains

Muriate of Soda,

————— Lime,

Carbonate of Iron,

————— Lime,

united with carbonic acid gas and sulphuretted hydrogen. These ingredients do not, however, exist in sufficient quantity to constitute a medicinal water.

The waters at Builth, a small town on the banks of the Wye, in Brecknockshire, are strongly saline, and resemble one another in their general properties. There are five springs, three of which are situated in the compass of a small room.

The saline is a strong spring, of a nauseous bitter taste, and very similar to sea water.

The chalybeate water has rather an austere taste. The emetic water, so called from its having that effect on some persons, has a saline sulphureous taste.

These waters give the following appearances with re-agents:—

Tincture of Brazil wood is changed to a blue colour, denoting the presence of a carbonated earth.

Carbonate of ammonia causes an immediate cloudiness, and detects the lime.

Nitrate of silver indicates the existence of muriatic acid; lead, that of sulphur; and prussiate of potash, iron.

Nitrate of barytes, after standing for some hours, produces a very light cloud, denoting the presence of a trace of sulphuric acid.

Caustic ammonia gives a white precipitation of magnesia.

Lime water is rendered turbid by the fixed air.

Hydro-sulphuret of ammonia occasions a dark green precipitate, which is re-dissolved by the addition of sulphuric acid, but instantly followed by a deposition of sulphate of lime.

The common idea, that the emetic water holds a minute portion of arsenic in solution, does not appear to be founded in truth; for that mineral could not exist for any length of time in a sulphureous water without combining with the sulphur to form an orpiment, which would be precipitated in the form of a yellow powder, perfectly inert.

The waters used for domestic purposes at Llandrindod, as well as the medicinal springs, have their source at a considerable depth, and rise through the crevices of the rock. There are three wells between the saline and sulphureous pumps, the tem-

perature of which varies from 54° to 58° , according to their exposure to the rays of the sun. Two of them are hard waters. Their hardness proceeds from the muriates of soda and lime, and is not therefore dissipated by boiling. At the approach of rain they exhale a halitus that obscures the transparency of the glass. Their specific gravity is 1001.5. They all contain carbonic acid, and change syrup of violets to a light green, shewing the existence of a carbonated earth.

The waters in particular districts correspond in their general properties, and owe their peculiar qualities to the strata over which they flow. Thus all the springs in the vicinity of Llandrindod contain lime; and the only one in which I could not detect it, was a small well in the garden at Howey, not far from the sulphureous water. This is a very pure water, and suspends only a little muriate of soda or common salt. Mr. Savary, in his Travels through Egypt, informs us, that at the little village of Materiè, or Ain Chams, (the Fountain of the Sun) some distance from the ancient Heliopolis, is a spring of fresh water, the only one in Egypt. He adds, "It is probable that the bed of earth through which the waters of the Nile filtrate into this foun-

tain, is destitute of the nitre universally found in that country. It is rendered famous by an ancient tradition, which says, that the Holy Family flying from the persecution of Herod, retired to this spot; it is held in the highest veneration both by the Christians and the Mahometans, who come with great devotion to drink the water for all their disorders."

Coal has long been suspected to exist in the neighbourhood of Llandrindod, but as yet none of this valuable article has been discovered there. From some late trials which were made near Builth, it was stated, that the appearances which not unfrequently accompany coal were met with. If the great quantity of iron-stone be considered as any proof of the presence of coal, its existence might be inferred; but as this is a subject in which a variety of circumstances require to be taken into consideration, I shall for the *present* refrain from making any further observations.

The sulphuret of iron or pyrites is by no means uncommon at Llandrindod; during its decomposition, from the influence of the atmosphere, the sulphuric acid combines with the lime to form selenite, or with the clay to form alumina, and a quantity of sulphuretted hydrogen gas is produced.

The iron is found in different degrees of oxydation. The peroxyd is much more abundant than the protoxyd, which latter is the most soluble in acids.

ANALYSIS

AN

ANALYSIS

OF THE

MEDICINAL WATERS

OF

Mlandrindod,

&c. &c.

THE
ANALYSIS
OF
THE
WATERS

ANALYSIS

MEDICINAL WATERS

BY
J. G. COOPER

LONDON

ANALYSIS

OF THE

Saline Carbonated Chalybeate, or Rock Water.

THIS valuable spring filtrates through a slate rock, depositing in its course a reddish brown precipitate. It is situated upon the common, a few feet above the level of Llandrindod brook, which runs close to it, and about a quarter of a mile west of the saline water.

This water has been said to bear a near resemblance to that of Lauchstad in Misnia, three miles from Leipsic; but from the account Hoffman has given us of the Lauchstad Spa, it would appear to be a simple chalybeate water.

In July, and in the autumn of 1816, when much rain had fallen during the summer months, the spring yielded a wine pint measure of water in one minute and twelve seconds of time. On the second of June, 1817, the supply was a wine pint in one

minute and ten seconds, and upon the 16th of June, when the weather was remarkably fine and dry, the quantity was still the same. Nor is it apparently increased in the most inclement seasons; from which it is probable, that the source of the spring is at a very considerable depth.

Derham, in his *Physico-Theology*, relates a similar instance of a spring at Upminster in Essex, which he had observed for twenty years, and could not perceive, by his eye, that its stream was augmented by the heaviest rains, or diminished by the greatest droughts.

In the summer of 1816, the temperature of the water varied from 52° to 54° Fahren. In June, 1817, it was steadily at 50° .

In the summer of 1816, the specific gravity of the water at the temp. 54° , the instant it was drawn from the spring was uniformly 1009.

On the 31st of May, 1817, when the temperature of the fresh drawn water was 50° , its specific gravity was 1004.5. On the 16th of June, at the temperature of 50° , its specific gravity was 1005.

When the specific gravity and temperature of a water vary, it is reasonable to conclude, that the proportion of its solid contents must also vary.

After standing in a room of the temperature 60°

for 12 hours, the water became sensibly heavier, which was owing to the place of the fixed air being supplied by caloric, for the temperature of the water was increased to 60°. This circumstance might have led the chemists of the last century to believe that the "Gas Sylvestre" rendered those waters that contained it lighter than others.

When taken up from the spring, the water is clear and transparent: numerous large bubbles are observed adhering to the sides of the vessel, which are much increased by agitation. To the taste it is saline and chalybeate, and possesses an agreeable briskness unaccompanied by any bitter flavour. A glassful of the fresh water was exposed to the atmosphere at the temperature of 60°; in twelve minutes it became of a pearly appearance; in fifteen, air bubbles were very apparent lining the sides of the vessel; in twenty, the opacity was much increased; in thirty minutes, a slight sediment commenced; and in twelve hours, a yellowish precipitate had fallen to the bottom; the transparency of the water was restored, and its saline properties predominated; the pellicle that covered its surface was scarcely visible, and to the smell, even when fresh drawn, the water did not differ in any way from common chalybeate waters. The pearly ap-

pearance arises from the deposition of the carbonated earths which are precipitated before the iron. These changes are much accelerated by agitating the water.

A phial, containing four ounces, was filled with the fresh water, and immediately closed with a ground stopper; in an hour, a loss of transparency had occurred; and in twelve hours, a delicate white precipitate was very evident.

A portion of the water was exposed in a glass flask to the temperature of 65° , air bubbles were immediately disengaged; at 75° , the water became pearly and opaque; at 80° , it had entirely lost its transparency. No other change appeared until the water became heated to 120° , when it assumed a yellowish colour, and became more turbid throughout. A sediment gradually formed, but the whole of the iron was not precipitated until the boiling temperature had been continued for a few minutes.

Glass vessels, in which this water has remained for a short time, after several washings retain a beautiful irridescent cast, which is easily removed by means of diluted muriatic acid.

A pint of the water kept in an open glass vessel for the months of October, November, and December, did not manifest any signs of putrescence;

whence we may conclude, that it does not contain the smallest trace of animal or vegetable matter.

It has been remarked, that those chalybeates which contain much animal and vegetable matter, recover their property of striking a dark colour with galls during the process of putrefaction; this is probably owing to the carbonic acid formed, redissolving the iron.

Analysis of the Rock Water by Re-agents.

Tincture of galls, added to the fresh water, occasions a pink colour, which gradually changes to a fine purple, approaching to black. This effect is not produced after the water has been boiled, or exposed to the atmosphere for a short time, demonstrating that the whole of the iron is suspended by carbonic acid gas.

Prussiate of Potash changes the fresh water to a beautiful blue, which in twenty-four hours is precipitated in the form of a prussiate of iron.

An infusion of green tea, in a few minutes, strikes a purplish lilac.

An infusion of black tea produces a light blue colour, which soon becomes of a dark purple.

The blue of Litmus is considerably heightened,

and when previously reddened by distilled vinegar, its colour is restored. Syrup of violets is rendered of a deep grass green, and the beautiful red of * Brazil wood soon becomes turned to a fine violet hue. But these effects, like that of the tincture of galls, are not produced after the water has been boiled.

The yellow of turmeric is not altered by the fresh water, or even after one gallon has been considerably reduced by evaporation, therefore the presence of a carbonated earth is indicated by the four preceding tests.

Nitrate of silver produces white clouds tinged with blue, which become dark on exposure to the light; when more than a few drops are added, the water assumes a reddish brown appearance, and after resting for half an hour, lets fall a grey precipitate.

Acetate of lead causes dense white clouds with a copious sediment of the same colour, shewing the existence of muriatic acid, and the absence of any sulphureous principle.

* The tincture of Brazil wood cannot be depended upon alone as a test of the presence of a carbonated earth, for it is itself decomposed by a simple solution of iron.

No sulphuric acid can be discovered by the delicate tests of nitrate or muriate of barytes, with or without the assistance of heat.

A little nitric acid was dropped into the fresh water, with the view of saturating the iron and calcareous earth, and afterwards some nitrate of barytes; but at the end of twelve hours, not the least cloudiness could be discovered.

The oxalate of ammonia, and the oxalic acid, denote the presence of a large quantity of lime; and the caustic ammonia, that of magnesia.

The caustic ammonia precipitates lime from the fresh water by combining with the fixed air; but both these changes take place after the water has been concentrated by boiling.

The fresh water curdles soap, and mixes smoothly into an opaline solution with milk.

The addition of lime water either before or after the water has been boiled, is quickly followed by a white flaky precipitate, detecting carbonic acid gas in the first instance, and magnesia in the second.

The carbonic acid is very loosely combined with the water. The gas flies off soon after it is taken up from the spring, and is chiefly, if not altogether employed in suspending the iron and carbonate of lime.

The nitro-muriate of platina and Tartaric acid do not disturb the transparency of the water.

Concentrated sulphuric acid causes an effervescence, which is more perceptible after the water has stood for a few minutes. It disengages the fixed air in combination with the lime, and renders the water milky. After some hours a sediment ensues, and it again becomes clear, when the muriatic salts will be found partially decomposed.

A few drops of the nitric, or muriatic acids preserve the water in its natural limpidity, and accelerate the escape of air bubbles.

Analysis of the Rock Water by Evaporation.*

As mineral waters contain many substances that cannot be detected by means of re-agents or tests,

* The evaporations must be conducted either in glass or Wedgewood ware basons; for the nature of the waters is materially altered by the common earthen utensils. The different precipitates were carefully dried at the uniform heat of 212° ; the filtering paper used was unsized; the mineral acids were remarkably pure, and every precaution was taken to render the experiments conclusive and correct. The muriatic acid was of the specific gravity 1170, and in the experiments alluded to, diluted with twice its weight of distilled water.

the process of evaporation is employed for the purpose of discovering the whole of their *solid ingredients*, and of ascertaining their different proportions.

When the rock water is boiled in a glass vessel it becomes turbid throughout, and of a brownish colour; the pellicle that incrusts its surface is more perfectly formed; the carbonic acid is driven off, and the iron and carbonated earths are precipitated.

When the process of evaporation is carefully conducted at a gentle heat, the solid contents of the water may be obtained. The muriates of lime and magnesia will be seen forming circles or waves round the sides of the bason, while the iron and carbonate of lime, confusedly intermixed with cubic crystals of muriate of soda, will be found at the bottom.

The salts procured, have an acrid and bitter taste; decrepitate when thrown on hot coals, but do deflagrate with charcoal; deliquesce rapidly on exposure to the atmosphere, and at a red heat fuse into an imperfect glass, which when cold again attracts moisture from the air. After the addition of vitriolic acid they evolve pungent fumes of muriatic

acid gas, which become visible on the approach of those of ammonia.

A wine gallon of the water was reduced by evaporation to half a pint, and the ferruginous precipitate collected and dried at 212° , weighed 11 grains; it effervesced with cold muriatic acid, and was partially dissolved. The metallic oxyd was not attracted by the magnet either before or after it had been exposed to a red heat, being melted with pure nitrate of potash, no trace of manganese could be discovered.

A wine gallon of the water was evaporated to dryness at a temperature far below the boiling point; the fixed principles were dried at 212° , and weighed

356.75 grains.

A. The 356.75 grains were digested in 1000 grains of highly rectified spirits of wine for twelve hours; the solution was frequently agitated, filtered, and the undissolved residue washed with a little fresh spirit; the alcohol having dissolved the muriates of lime and magnesia, the remaining portion was dried at 212° , and weighed 251 grains.

B. The 251 grains were digested for 24 hours in 12 oz. of cold distilled water; the mixture was fre-

quently stirred with a glass rod, and separated from the insoluble matter, which was well washed with distilled water, dried at 212°, and weighed 11 grains.

C. The ferruginous precipitate was moistened with water and exposed to the sun's rays for six weeks, when it acquired oxygen, which rendered the iron insoluble in acetic acid.

	<i>Grains.</i>
A. Muriates of lime and magnesia.....	105.75
B. Muriate of soda	240
C. Ferruginous precipitate	11
	356.75

A. a. The spirituous solution was evaporated to dryness, and the muriatic salts decomposed by the addition of half their weight of concentrated sulphuric acid. The excess of acid was expelled by an increase of temperature, which was continued until pungent fumes ceased to arise. The two sulphates were separated by cold distilled water, which dissolved the sulphate of magnesia, and left the sulphate of lime untouched; the latter was washed with a fresh portion of water, and boiled for fifteen minutes in three times its weight of carbonate of

potash; the sulphate of potash was washed off, and the carbonate of lime formed, saturated with pure muriatic acid, diluted with a small quantity of distilled water.

The muriate of lime was dried at 212° , and weighed

57 grains.

b. This being deducted from 105.75, leaves for the muriate of magnesia

48.75 grains.

B. a. The aqueous solution, which contained only muriate of soda, was reduced to dryness at a degree of heat between 80° and 90° ; the residuum was dried at 212° , and weighed

239 grains.

C. a. The ferruginous precipitate was digested in 240 grains of pure acetic acid for twelve hours; the insoluble matter was washed with distilled water, dried at 212° , and weighed

7.5 grains.

b. This residuum was boiled in diluted muriatic acid for twenty minutes, and left undissolved

1.33 grain,

of a light-coloured substance, which became perfectly white on exposure to a red heat, and was found to consist of silex.

c. This being deducted from 7.5, leaves 6.17 grains, for the carbonate of iron.

d. The acetic solution which had dissolved carbonate of lime, was neutralized with crystallized carbonate of potash, and the precipitate collected, washed, and dried at 212°, weighed 3.4 grains.

According to this analysis, a wine gallon of the rock water contains, of

	<i>Grains.</i>
A. a. Muriate of lime	57
b. ———— magnesia	48.75
B. a. ———— soda	239
C. a. d. Carbonate of lime or chalk....	3.4
b. Silex or flint	1.33
c. Carbonate of iron	6.17
	355.65
Loss in the different processes, chiefly muriate of soda	1.1
Total.....	356.75

Analysis of the Gaseous Contents of the Rock

Water.

A glass flask, which with its syphon contained exactly sixteen ounces and two drachms, was com-

pletely filled with the fresh water, and gradually heated by means of a spirit lamp; upon the first impression of the heat, the water expanded; the two drachms contained in the syphon were suffered to escape, and deducted from the results of the experiment; the boiling temperature was continued for four hours, when the whole of the gas was extricated, and being received over mercury, when the barometer stood at 29°.8, and the thermometer at 58°, amounted to

1.375 cubic inch,

or, for the total quantity of gas, per gallon,

11 cubic inches.

The 1.375 being submitted to the action of lime water, the carbonic acid gas was absorbed, and afterwards to a solution of green sulphate of iron saturated with nitrous gas, no diminution of bulk appeared at the expiration of six hours; but the remaining gas extinguished a lighted taper, and possessed the characters of azote; and as the results of the several examinations, the following proportions were obtained, of

Carbonic acid, or fixed air 0.775

Azotic gas, or nitrogen..... 0.60

1.375

or, per gallon, of

	<i>Cubic inches.</i>
Carbonic acid	6.2
Azote.....	4.8
	—
	11
	—

The slate rock, the nature of which has been described, is in many places stained of an ochery appearance, and from one of these a small spring rises, guttatim; from its scarcity, or from a supposition that it was stronger than the rock water, it was vulgarly called the brandy drops. I caused a small well to be dug in the rock, and examined the water with various re-agents.

Tincture of galls instantly occasioned a fine pink, but did not upon long standing acquire a dark purple hue*.

Syrup of violets produced a deep grass green.

Oxalate of ammonia indicated lime.

Nitrate of silver, detected muriatic acid; acetate of lead and nitrate of barytes, denoted the absence of sulphur and sulphuric acid; sulphuric acid rendered

* The same remark was made by Dr. Linden.

the water turbid, and disengaged a few bubbles of air; the temperature of the well was 55°.

Upon evaporating a wine pint, I obtained a residuum of 44 grains, or in the proportion of 352 grains of solid contents in the gallon.

The quantity of salt contained in a gallon, is equal to that of the rock water; but it is by no means so strong a chalybeate.

A comparative statement of the proportion of foreign ingredients procured from a gallon of the rock water.

	<i>Grains.</i>
In July, 1816, specific gravity 1009	356.75
In Sept. ditto ditto ditto	356.75
In June, 1817, ditto 1005	328.

ON THE

MEDICINAL PROPERTIES

OF THE

Saline Carbonated Chalybeate, or Rock Water.

A REVIEW of the analysis of the rock water will enable us to determine the diseases in which it may be safely administered, and shew the propriety of ranking it among the saline carbonated chalybeates. Dr. Saunders, in his excellent "Treatise on Mineral Waters," justly observes, that "some of the most valuable mineral springs belong to this class."

Few mineral waters that we are acquainted with in this or any other country, contain so large a proportion of iron; and when we consider, that the most active form in which this metal can be exhibited as a medicine, is in the state of solution by carbonic acid gas, the greatest advantages may be expected from the use of the rock water.

The iron in the state of a carbonate, is more easily acted upon by the gastric juice than when combined with oxygen, or with the mineral acids.

The powerful effects that the fresh water produces on the constitution, would lead us to suppose, that it contained a much greater proportion of fixed air than could be extricated from it by the process of distillation; and there are good reasons for believing, that large quantities are continually rising up from the spring; yet its adhesion to the water is shewn to be extremely slight, from its transparency being so soon impaired; and the circumstance of the water's not reddening litmus, leads me to infer, that the whole of the carbonic acid is altogether employed in suspending the iron and carbonate of lime.

The gas is disengaged during the process of solution in the stomach, and exerts its immediate effects on the nervous system.

Carbonic acid, although fatal to animal life, when respired, may be drank in small quantities with perfect safety; it acts as a general stimulus to the nerves, and often occasions symptoms similar to those which follow an immoderate use of vinous or spirituous liquors: persons, therefore, who are subject to a fulness of the vessels of the head, should

be careful to avoid the use of all fermented beverages.

Carbonic acid has been found particularly soothing to irritable surfaces; it is abundantly produced in the different operations of Nature, and while oxygen supports the respiration of animals, this gas enters into the structure of vegetables, and a variety of calcareous spars, lime-stones, &c.

All waters that contain iron, suspended by carbonic acid gas, have more or less of an astringent quality. They quicken the pulse and increase the florid colour of the blood. They exhilarate the spirits, promote the appetite, and cause a sensible determination to the skin and kidneys. They constringe and strengthen the muscular fibres of living animals, and are often used with success in removing general debility, and in restoring the tone of the alimentary canal.

If the water contained oxygen gas, it would probably be more or less impregnated with sulphuric acid; for the oxygen would decompose the pyrites in its course through the rock, and the water would be different in its composition.

The influence of azote as a medicine has never been ascertained. It is found plentifully in the waters of Bath, Buxton, and Harrowgate, and may

exert some useful power that we are hitherto unacquainted with.

To the silex I cannot impute any medicinal virtues, although it has been suggested by Dr. Gibbes, who discovered it in the Bath waters, to assist materially in their general effect.

The carbonate of lime will afford great relief in correcting the acidity of the stomach, so often productive of the heart-burn.

The saline principles of the water are very considerable, and require particular attention in a medical point of view, as the dose of the water must in some measure be proportioned to their action on the bowels.

The muriate of soda, or common salt, is one of the most important articles in domestic economy; it acts as a stimulus to the whole body, and has been found useful in some cases of dyspepsia. It forms the principal ingredient in a stimulating bath, and may, by the irritation that it excites, produce a new action in the skin.

The analysis of these waters clears up any doubt that may remain with regard to the aperient qualities of lime and magnesia, for as they contain no other purging salts, the effects which they produce on the bowels must be attributed to the earthy

muriates. Dr. Saunders, when speaking of the earthy muriates, remarks, "that the power which they *may* possess of acting on the intestinal canal is not quite ascertained; but from their great solubility, and from analogy with salts of a similar nature, we may, I think, conclude, that this forms a principal part of their operation." And that his opinion was correct, may be fully illustrated by the effects of the Llandrindod waters.

The muriate of lime has a disagreeable bitter taste. It is found in a variety of salt springs, and in the waters of the Dead Sea. It has been recommended in scrophulous and glandular diseases, and in cases of general debility: in an over-dose it has excited "qualms and sickness, and has been known to destroy dogs." The property of this salt in generating intense cold during its solution, or when mixed with snow, has also been applied to medical use.

The muriate of magnesia is not uncommon; it possesses a very bitter hot taste, and is the salt that gives the bitterness to sea water. A pint of sea water contains about 51 grains of muriate of magnesia, and this quantity, combined with about 186 and $\frac{1}{2}$ grains of common salt, is a sufficient dose for

the generality of patients; we may then safely ascribe no inconsiderable purgative qualities to this salt.

The sensible effects of the rock water are those of a powerful tonic; it invigorates the languid constitution, and improves the system that has been injured by long and continued exertion.

The water will be found beneficial in all cases of an universal languor and weakness, that proceed from a relaxation of the stomach and of the fibres in general: in relaxed, gross habits; in some species of the lepra; and, other cutaneous diseases, which depend on debility. The herpetic affections here alluded to, are those that are accompanied with a dry and scaly appearance of the skin, dispersed over the surface of the body in reddish patches, and which are most frequently cured by alterative and tonic medicines; in hysteria, and hypochondriasis; in the fluor albus and gleet; in spasmodic disorders arising from a weak and irritable state of the nerves; and in those obstructions which most frequently disturb the healthy functions of the female constitution.

It may be employed in such asthmatic disorders, and chronic coughs, as originate from a relaxation

of the pulmonary vessels: but here, some discrimination will be necessary, and its use must be cautiously regulated.

This water has been found particularly serviceable during the time that it was drank, in relieving the symptoms that indicated a morbid affection of the lungs, accompanied with cough, and purulent expectoration, when unattended by hectic fever. In such cases I have known it check the discharge of pus, and contribute much to the comfort of the patient.

In weak and irritable habits, where the pulse was remarkably quick, the water has been observed to reduce its frequency, and to increase its strength.

Its use should be carefully avoided in full and plethoric habits, before the body has been cooled by proper evacuations, especially if there is any determination of blood to the head, or chest: in cases of confirmed obstructions attended with fever; or even when local congestion exists without fever; in chronic inflammation of the liver, and hot bilious habits; but "chalybeates may be used to advantage, with the view of giving that tone and energy to the system, so very defective in cases of jaundice."

In calculous complaints, when the stone owes its

formation to the uric acid, and is accompanied with ulceration of the bladder and a discharge of matter, the water may be employed; but I would not recommend it when the stone is composed of lime or magnesia, as it might tend to increase the disposition to the disease: neither would it be proper to advise the water in diabetes; because in the healthy state of the body it increases the excretion of urine; but in rickets and mollities ossium, where there is great debility and a deficiency of lime, the water may deserve a trial.

In chlorosis, from the active form in which the iron exists in the rock water, the most decided advantage may be expected. "Chlorosis is a disease accompanied with a diminution of the quantity and activity of the bile, preceded by affections of the stomach; such as loss of appetite, indigestion, and flatulent eructations." Dr. Saunders further observes, that "if we were to point out one disorder which above all others received benefit from mineral waters, it would probably be this; even at the time that the feverish irritation which always subsists, the head-ache, and frequent dyspnœa, might seem to forbid its use. This, however, appears a striking exception to the general rules for treating complaints attended with fever, since it is

found that chlorosis even in its inveterate stage, where not actually accompanied by the inflammatory symptoms, that precede any internal suppuration, will almost always bear, and be the better for every kind of chalybeate medicine*.”

“ In this complaint the strictest attention must be paid to the diet; it should consist principally of animal food: the influence of which, in producing a rich blood and increased secretion of bile, is amply proved by daily experience; together with the careful avoidance of all vegetable acids, which diminish the red globules of the blood, and by destroying the activity of the bile, bring on a pale, exsanguineous complexion†.”

The warm bath has been strongly recommended by Hoffman; and most authors have concurred with him in bearing testimony to the good effects which follow its use in cases of chlorosis: it should therefore be had recourse to, until the patient is able to overcome the sedative effects occasioned by a sudden submersion in cold water; when the tepid, or cold bath, will be found more invigorating remedies.

* Saunders's Essay on Mineral Waters.

† Saunders on the Liver.

The rock water proves extremely serviceable in debility of the uterine vessels, which, if neglected, produces obstructions and sterility in females. It is likewise sometimes employed to restrain preternatural evacuations from the womb, to give strength to the extremities of the debilitated vessels; but with regard to an increased discharge of the menses, the water should not be allowed when it is attended with febrile symptoms; and it should be remarked, that it is in those diseases which arise from general debility, and are unassociated with any organic defect, where the water promises to afford the happiest effects.

In Chorea Sancti Viti, or Saint Vitus's Dance, a disease to which delicate children of both sexes are subject, the rock water will, from its tonic powers, afford very considerable relief.

This complaint is attended with great debility and irritability of the nervous system; the voluntary powers cease to obey the dictates of the mind, and it is often accompanied with fatuity.

Physicians have differed much in their treatment: some have effected a cure by bark, chalybeates, and the cold sea-bath; others, by local venesection and drastic purges.

The proximate cause appears to consist in a con-

gestion of blood in the veins of the pia mater; they have been found more than ordinarily distended, and it is probable that the circulation of the blood through the brain is impeded by the debilitated state of the vessels; it is therefore highly proper, that the local congestion should be removed by means of leeches, blisters, or aperient medicines, previous to the exhibition of tonic remedies.

At the commencement of a course of the rock water, some preparation will generally be required; the patient should pay particular attention to his stomach and bowels, for when they are not properly evacuated, several inconvenient sensations very frequently arise: the water is then apt to disagree, and occasions vomiting, fulness of the head, and uneasy distention of the stomach and bowels. In some cases it has been known to produce convulsions, and I have more than once seen a considerable bleeding excited from the nose, when no precautionary measures had been taken. "The purest waters will in certain habits, especially the debilitated, occasion some degree of vertigo and determination of blood to the head, when first drank, which usually go off in a few days;" but when these symptoms come on during the use of the rock

water, they should be removed by appropriate medicines before it is persevered in.

With regard to general blood-letting, I am of opinion, that wherever it will be thought necessary, the rock water ought not to be employed, and the patient would probably be most benefited by a course of the saline water.

During the summer months, the country people who resort to this spring, are in the habit of drinking from twenty to thirty half pints in a morning before breakfast, without feeling any inconvenience: when drank in such immoderate quantities, the ill effects which follow an overdose are prevented by its operation on the bowels; but those happy results which follow a more judicious use of the water, are not produced on the constitution.

For the reasons which have been stated, it is of the greatest importance that the water should be drank immediately upon being drawn from the spring; but should the patient be prevented from going to the spot by the inclemency of the weather, or any other cause, its qualities will be best preserved by carrying it in a bottle, closely corked, with the neck downwards, at a low temperature; the gas then ascends to the upper part of the vessel,

and is not so liable to be lost. The water will not, however, even in the closest stopped phials retain its virtues long, for the iron is soon precipitated from its solvent, and left in a comparatively inert state.

The coldness of the water will in many cases have a salutary influence, and contribute much to the warmth and general glow experienced by the patient after a dose of the water, which may depend very much on the re-action that succeeds the impressions made on the stomach in the same manner as when cold is applied to the surface of the body, for it is well known that a glass of cold spring water will often produce a sensation of heat and perspiration upon the skin; and as the water cannot be made warm without destroying its active properties, those persons whose stomachs are incapable of retaining the fresh water, may combine a little spirits of cinnamon or nutmeg with it, until they have gained sufficient strength to overcome the nausea and sickness occasioned by the cold water. The aromatic tinctures which are generally recommended for this purpose, contain an astringent principle which decomposes the iron, and must therefore be considered as improper additions,

Since the rock water cannot *always* be taken with safety in such large quantities as to act decidedly on the bowels, costiveness sometimes attends its use, and in these cases the saline water should be drunk two or three times a week, so as to keep the bowels open ; or the rock water itself may be employed for this purpose, after its gaseous principles have been suffered to exhale ; I should, however, prefer the saline water, because it will be found more grateful to the palate. It does not appear to me that the chalybeate properties of the water prevent its influence on the intestinal canal, for when taken to the extent of from four to seven half pints, the water occasions several evacuations, and it certainly may be considered as an advantage, that the water does not purge in a less quantity, otherwise its chalybeate properties would be carried off before they could be assimilated and received into the circulating system, therefore if a few doses are found to have this effect, the saline water will not be required, and I would recommend that a smaller dose should be administered.

The most proper time for drinking the water is early in the morning, before breakfast, and again at noon ; many patients are in the habit of repeating

the dose in the evening, but this practice admits of many exceptions, and may even sometimes be attended with danger.

The exact quantity to be taken daily must of course be regulated by the several circumstances of the age and constitution of the patient, and the nature of the disease, but more particularly according to the effects which it is found to produce on the individual.

The glasses should not contain more than one quarter of a pint, or four ounces; a glassful may be taken in the morning, and another between breakfast and dinner; in a few days the quantity may be increased to three quarters of a pint, or a pint. When it is intended to act as a general tonic, the total amount taken daily should never exceed one quart; but there are some cases in which the water may be administered in larger doses, so as to operate two or three times in the twenty-four hours.

The signs of its agreeing with the patient are, increased appetite and spirits, a general glow and feeling of warmth upon the skin, a sensible determination to the kidneys, and the gradual improvement of the health and strength. When the water

disagrees, it occasions flushings of the face, fulness and heaviness of the head, bleeding at the nose, involuntary spasms, disturbed sleep and dreams, heat, thirst, and other febrile symptoms.

The water sometimes induces hæmorrhoidal affections, eruptions upon the skin, and a disposition to erysipelatous inflammation; its use should then be laid aside, and the body be more prepared for its reception.

It is most advisable to begin with a small quantity, in order that its effects may be observed, and gradually to increase it, as experience teaches us, that chalybeates lose much of their influence by long habit. The same rule must be applied here in drinking the water as is followed upon the introduction of any cold fluid into the stomach; it should not be taken when there is any great sense of chilliness present, or after a general perspiration has commenced.

The water should be drank in repeated draughts at intervals of from fifteen to twenty minutes, which should be employed in exercise. It may not be requisite to expatiate on the kind and degree of exercise, as this must depend entirely on the strength of the invalid: those that are able may walk, or

ride about the common, when the weather is favourable; but should never continue their exertion, so as to bring on fatigue, or much perspiration.

An attentive regard to diet is strictly necessary. Tea at breakfast, and other vegetable astringents that decompose the water should be avoided, and ought not to be taken soon after; but cocoa, chocolate, or milk, may be used with propriety; and in the evening tea may be taken without disadvantage*. The hour of dining at Llandrindod is at three o'clock, and it would be most proper that at least an hour should elapse between the taking of the water, and a meal.

The general diet should consist of animal and vegetable substances that are light and easy of digestion. The quantity taken at one time should be moderate. The use of high-seasoned food, or of vegetables that are too acescent, cannot be admitted. Water, or white wine and water may be drank at meals, and will much assist the power of the rock

* In some instances, when the patient complains of any irritation excited by acrid discharges, the water may be combined with an equal quantity of milk, which will assist in relieving the unpleasant symptoms.

water. The "Dieta Aquosa" is in general carried too far at Llandrindod, and I would recommend that a glass or two of white wine should be taken after dinner.

In some cases, brandy much diluted may be used; but as spirituous liquors have a strong tendency to diminish the activity of the bile, and excite diseases of the liver, they should never be indulged in.

It may be expected that I should make some remarks on the medicines which might be administered in conjunction with the rock water; further than what has been advanced in preparing the body for its use, and the occasional employment of the aloetic pill, or a few grains of calomel, the water should always be allowed a fair trial in its natural state, and from the analysis which has been given, it does not appear to me, that it will be found deficient in power.

Chalybeate waters have rarely been proposed as remedies for very young children; their complaints in general are such as do not require a tonic and stimulating medicine, under the age of eight or ten years; the rock water may not therefore be productive of good effects; nor can it be considered

a proper medicine for elderly persons of either sex, particularly females, at that period, when their constitution undergoes a change.

With respect to the requisite duration of a course of the water, this must depend very much on the nature and extent of the disease. When its employment is judiciously managed, the patient soon begins to feel its beneficial effects, and these continue long after the water is left off. A shorter period than three weeks scarcely justifies the expectation of any material advantage, and a longer one than two months, or at the utmost three, is not required to produce all the good effects of which it is capable. During this period the water should be occasionally omitted for a few days together, by which the stomach will be relieved, and its influence not be so likely to wear off from constant habit.

The season for drinking the water is during the whole of the summer months, from May to November, or earlier, if the weather is fine and warm enough to allow the patient to rise early and take regular exercise, or when the complaint is of such a nature as to demand the more immediate assistance of the water.

ANALYSIS

OF THE

Saline Pump Water.

THE stream of this water flows from the south, and affords a sufficiency for the invalids who resort to Llandrindod; the supply is not however very plentiful, and the well is occasionally pumped dry for an hour.

The well is sunk about six feet below the surface of the ground, and is secured from any accidental admixture with other springs.

In closely corked bottles the water will bear carriage to some distance, and will retain its purging qualities; but from the volatile nature of its gaseous contents, cannot be so efficacious as when drank at the pump.

Corked bottles that have been filled with the fresh water, and afterwards immersed in a hot fluid,

or set in a warm place, presently burst from the expansion of the gas.

The sensible qualities of the saline water when drawn immediately from the pump, are, it is quite clear, colourless and bright; it does not sparkle in the glass after the first agitation of the water is gone off: to the taste it is weakly saline, and exhales a perceptible sulphureous odour; but is by no means unpalatable, the bitterness of the earthy salts being concealed by the muriate of soda.

After being exposed to the atmosphere for a few hours, the smell is entirely lost, the water appears full of globules of air that line the inside of the glass; it retains its transparency for some days, when it becomes slightly turbid, a delicate white pellicle encrusts its surface, and a scanty precipitate subsides.

In the summer of 1816, the temperature varied from 53° to 54° ; in July, at the temperature 54° , the specific gravity of the fresh water was 1006.5; in October, after there had been much rain, at the same temperature, it was 1005.

On the 31st of May, 1817, the temperature of the water was 52° , and its specific gravity 1005.4.

Although the thermometrical temperature of the saline and sulphureous waters does not commonly

differ more than one or two degrees, the former produces a much greater sensation of cold when its temperature is equal to the other.

This water differs very much from the Cheltenham, both in the nature of the acid and of the base, to which it owes its aperient properties: as may be seen by the following analysis.

Analysis of the Saline Water by Re-agents.

Experiment 1.—Tincture of galls, when added to the fresh water, strikes a fine light purple tinge, which in a few hours becomes of a deeper cast; a dark flocculent precipitate falls to the bottom of the glass, and the water above appears of a yellow or greenish colour.

2. Half an ounce of infusion of green tea was poured into a gallon of the water, and produced a purple colour, which gradually subsided in the form of a black precipitate.

3. Prussiate of potash occasioned only a light green cloud, which did not, upon long standing, acquire the least shade of blue.

4. A few drops of nitric acid were added to a gallon of the fresh water, and it was suffered to rest for twelve hours, when no change whatever was

produced either by tincture of galls or infusion of green tea; nor were these re-agents affected by the water after it had been boiled or exposed to the air for an hour.

5. Tincture of litmus is not immediately altered, but in about ten minutes the surface of the water is very slightly reddened, and after several hours becomes of a violet colour.

6. Tincture of Brazil wood dropped into a gallon of the water is evidently discoloured, and precipitated of a purplish hue.

7. Syrup of violets is in a few minutes rendered of a beautiful grass green, which in a short time becomes more deep.

8. The delicate yellow of turmeric paper was not impaired after lying in a gallon of the water for twelve hours.

9. Carbonate of ammonia causes an abundant precipitate.

10. The caustic alkalies render the water turbid.

11. A solution of soap is curdled.

12. Nitrate and muriate of barytes do not indicate the smallest trace of sulphuric acid.

13. Lime water produces a considerable turbidness when mixed with the fresh water, or after it has been boiled.

14. Concentrated sulphuric acid destroys the transparency of the water, and causes a precipitation of lime.

15. The muriatic and nitric acids preserve the water in a clear state, and disengage a few bubbles of air.

16. Nitrate of silver occasions white streaks, tinged with blue, which soon acquire a dingy yellow, with a copious sediment.

17. The water concentrated by boiling, afforded a white precipitate, with this test.

18. Oxalate of ammonia produces dense white clouds.

19. Characters written upon paper with a solution of acetate of lead, became of a dark brown colour when held over the surface of the water for a few minutes.

20. Nitro-muriate of platina denoted the absence of salts with a base of potash.

21. A solution of muriate of ammonia was not changed.

Inferences.

From the preceding experiments we derive the following conclusions:—

That the change produced upon the tincture of

galls and green tea, is occasioned by the action of the sulphur. Exp. 1, 2, 4.

That the quantity of iron contained in the water is so exceedingly minute, that it can scarcely be detected by the most delicate test. Exp. 3.

That the saline water contains fixed air or carbonic acid in an uncombined state. Exp. 5.

That a carbonated earth is present. Exp. 6.

That a carbonated alkali does not exist in the water. Exp. 8.

That the water contains lime, and probably in no inconsiderable proportion. Exp. 9, 14, 18.

That no saline or earthy base, united with sulphuric acid can be discovered in the water. Exp. 12.

That the water contains magnesia, is shewn by the caustic alkalies, and the effect of lime on the boiled water. Exp. 10, 13.

That the acid, in combination with the different salts is the muriatic. Exp. 16, 17.

That it is a hard water. Exp. 11.

That the water contains a sulphureous principle. Exp. 7, 16.

That sulphur is evolved from the water in a gaseous form. Exp. 19.

Analysis of the Saline Water by Evaporation.

By the action of heat the water is rendered a little turbid; the sulphur is partly deposited and partly conveyed off by the hydrogen gas, which holds it in solution. The salts obtained by evaporation have a greyish colour, and in other respects are not dissimilar to those procured from the rock water.

Twelve pints were considerably reduced by evaporation, and after the sediment which ensued had been separated by a filter, the remaining fluid was further concentrated until a crystallization commenced on the surface, when it was set aside to cool. The salts thus obtained were of a cubic figure, decrepitated when thrown on hot coals, fused at a red heat, and sublimed without decomposition, which are the distinguishing marks of muriate of soda.

The brine afforded a white flaky salt, composed of the muriates of lime and magnesia; its taste was extremely acrid and bitter; it fused at a low red heat without crackling, and remained perfectly dry when properly secured from the atmosphere; but upon exposure, deliquesced very rapidly.

The sediment separated by the filter effervesced

with diluted muriatic acid, and was insoluble in spirits of wine, with the exception of a little vegetable matter, which gave the solution a yellowish colour.

A. A wine gallon of the water was evaporated to dryness by a very gentle heat, and afforded 342 grains of solid contents, which were digested for eighteen hours in 1000 grains of highly rectified spirits of wine. The solution was separated, and the insoluble matter washed with a little fresh spirit, and dried at 212°, weighed 250 grains.

B. C. The 250 grains were digested for twenty-four hours in 12 oz. of cold distilled water; the residue was collected, washed, and dried at 212°; it weighed 5.8 grains.

	<i>Grains.</i>
<i>A.</i> Murates of lime and magnesia..	92
<i>B.</i> Muriate of soda	244.2
<i>C.</i> Insoluble residue	5.8
	342.

A. a. The alcoholic solution was evaporated to dryness, and the salts, dissolved in a little cold distilled water, were decomposed with effervescence by means of a cold solution of carbonate of ammonia, that had previously been exposed to the atmosphere

for several hours. The muriate of ammonia was washed off from the carbonate of lime, which was saturated with very pure muriatic acid, diluted with a small quantity of distilled water; the muriate of lime thus formed was dried at 212° , and weighed

67 grains;

b. This being deducted from 92, leaves for the muriate of magnesia,

25 grains.

The solution, after the carbonate of lime had been separated, gave a white precipitate with phosphate of soda.

B. a. The salt taken up by the aqueous solution, consisted entirely of muriate of soda; it remained permanent in the air, and when evaporated to dryness, crystallized in cubes and quadrangular spangles.

C. a. The 5.8 grains which had resisted the action of the spirits of wine and of water, were digested in cold diluted muriatic acid for two hours; the residue was washed, dried at 212° , and weighed

5.2 grains.

It was composed of vegetable matter.

b. The muriatic solution was diluted with distilled water and divided into equal parts; a few drops of oxalate of ammonia being added to a

portion of it, no precipitation or loss of transparency ensued; but with the caustic ammonia, the presence of a small quantity of magnesia was indicated in the other.

A wine gallon of the water appears, from these data, to contain, of

	<i>Grains.</i>
<i>A. a.</i> Muriate of lime.....	67
<i>b.</i> ————— magnesia	25
<i>B. a.</i> ————— soda	244.2
<i>C. a.</i> Vegetable matter	5.2
<i>b.</i> Carbonate of magnesia	6
	Total 342

Analysis of the Saline Water by Distillation.

A glass flask, which with its syphon contained exactly sixteen ounces and two drachms, was completely filled with the water, and gradually heated by means of a spirit lamp; upon the first impression of the heat the water expanded, and the two drachms contained in the syphon were suffered to escape, and deducted from the results of the experiment, which was repeated several times with similar conclusions.

The gas was received over mercury, and the boil-

ing temperature continued until no more came over. The sulphuretted hydrogen, that was not decomposed by the mercury, was absorbed by a hot solution of nitrate of silver, and there remained in the eudiometer

1.125 cubic inch,

when the barometer stood at 29°.8, and the thermometer at 58°.

The gas was transferred into a phial filled with lime water, and frequently agitated; the carbonic acid was thus separated from the azote, and gave for their respective proportions, of

	<i>Cubic inch.</i>
Carbonic acid gas.....	0.50
Azote	0.625
	1.125

Or, per gallon, of

	<i>Cubic inches.</i>
Carbonic acid gas	4
Azote	5
	9

To determine the quantity of sulphuretted hydrogen, the gaseous products of sixteen ounces of the fresh water were received over boiled water of

the temperature 100°, and at the conclusion of the process, immediately transferred into a hot solution of nitrate of silver; a diminution of bulk ensued equal to 0.125, making for the total quantity of sulphuretted hydrogen, per gallon

1 cubic inch.

The saline water is subject to very little variation in its specific gravity; hence the proportion of its solid contents is usually about the same.

	<i>Grains.</i>
In July, 1816, a wine Gallon yielded.....	342
In June, 1817, Do. Do. Do.	346.

ON THE

MEDICINAL PROPERTIES

OF THE

Saline Pump Water.

By far the greater number of persons, who resort to Llandrindod, derive the most benefit from drinking the saline water.

It cannot, however, be taken with impunity, and requires that some attention should be paid to the constitution of the patient previous to its use. In general, a few grains of calomel administered the preceding evening at bed-time will be sufficient, and may be worked off the following morning by the water.

But when the bowels have been long disordered, or the patient is of a full plethoric habit, a further preparation will be required. In the latter instance it may be proper to allow a part of the carbonic acid gas to escape, either by warming the water, or exposing it to the atmosphere for a short time before it is drank.

General blood-letting is very rarely necessary; yet there may be some cases in which it would form a part of the plan of treatment, and a professional gentleman ought to be consulted as to its propriety. When taken to the extent of from three to eight, or ten half pints, the water occasions several evacuations, which may be regulated by the number of glasses taken after the first motion has been procured. The purgative effect of the water is much increased by the aid of warm fluids, and when a few glasses are found insufficient to operate upon the bowels, it will be most advisable for the patient to drink half a pint of the water that has been warmed, and this is best done by adding to the cold water some that has been previously made hot.

The aperient qualities of the saline water are often promoted by alternately combining a glass or two of the sulphureous water along with it.

The number of glasses required to purge, varies considerably with different persons; hence the water is often drank in much too large a quantity. If the means that have been recommended do not render the water sufficiently strong to produce the desired effect, it would certainly be most prudent to mix some *Glauber's salts* with the water rather

than to go on drinking glass after glass until it operates.

Salts of a similar nature to those contained in the water, might easily be obtained by the process of evaporation and crystallization, and when the muriate of soda has been separated from the deliquescent salts, the latter may be preserved in a state of solution, and added to the water as occasion may demand.

Some discrimination is occasionally required, to determine whether the water ought to be used so as to produce its full effects on the bowels, or more particularly to promote the excretion of urine, both of which may be effected according to the method of administering the water.

The sensible effects of this water, upon taking it, are a slight degree of drowsiness and head-ache, which usually go off after the first day. Sometimes these symptoms continue during its use, and come on more especially in the evening, after dinner, even when the bowels have been freely evacuated in the morning, and may be attributed to the influence of the carbonic acid gas.

Patients who drink the water incautiously in large doses, suffer very much, unless it purges them

briskly, and they often complain of great distention of the stomach and bowels, flushings of the face, with a strong disposition to sleep, and dryness of the mouth and fauces; in weak and irritable habits, the water is apt to excite some degree of thirst, even when used in small and repeated doses. These unpleasant symptoms may be removed, by procuring an evacuation from the bowels as quickly as possible.

It may be proper to mention, that when the water operates entirely by urine, and does not cause a determination to the intestines so as to unload them of their contents, the invalid will not be much benefited; and if the use of the water is persevered in, it only induces debility and nervous irritation.

The saline water sits lightly on the stomach, and acts on the bowels in a very gentle and mild manner, without occasioning griping, or leaving that languor and weariness which often succeed the operation of the common neutral salts; and may be persisted in for several weeks without losing its effect, or inducing any great debility; during its employment, the spirits and general health of the patient will be much improved; and this invigorating power may be ascribed to the stimulus of the

carbonic acid gas, and of its other saline ingredients on the stomach and digestive organs; yet, when the water is drank for a long time, so as to cause a great determination to the bowels, some degree of debility and lassitude is felt, and not unfrequently the rock water may be recommended with success, after the use of this water, for the removal of bilious complaints.

The saline water should be taken early in the morning, in doses of half a pint each, at intervals of from ten to fifteen minutes; the patient should take moderate exercise in the open air till it operates, and when it has given one or two motions, he may return to breakfast, but the fast should never be broken until such time as the bowels have been opened once at least.

With the few exceptions that have been mentioned, it is always most judicious to allow the water a fair trial at its natural temperature, not only because it is more pleasant and agreeable to the taste, but that its coldness will, in many instances, have a beneficial influence, and by the reaction which it excites, very much improve the tone and energy of the stomach.

During a long course of the water, it will often be of service to discontinue its use for a few days,

and sometimes the sulphureous water may be combined with it to advantage.

Many patients are in the habit of drinking it with their meals, and at all hours of the day; but those who consult their health will avoid this practice, which may be attended with the most serious consequences: indeed, the best authors who have written on the subject of mineral waters, have been so fully convinced of the importance of this regulation, that they have expressly forbid their use at meals, or even for several hours afterwards.

The saline water has been found a valuable remedy in hypochondriasis, and in a long train of nervous diseases that proceed from a vitiated state of the bile; in chronic rheumatism; in obstinate and habitual costiveness; in scorbutic disorders; in scrophula; in a variety of glandular obstructions, and when the stomach is loaded with a viscid mucus inducing nausea, sickness, and a morbid state of appetite; in cases of hæmorrhoidal affection, and intestinal worms.

“Persons who, from a long residence in warm climates, or from leading a sedentary life, and great application to business, have had their biliary organs injured, and are labouring under an irregularity in the secretion of bile, with languor and torpor

of the mind, loss of appetite, and indigestion*," may often be restored to convalescence by a course of the saline water, and a strict adherence to the rules of diet, air, and exercise.

Hypochondriasis is a complaint to which persons of the melancholic temperament, with dark hair and complexions, are the most liable; and they are also more subject to a redundancy of bile, which, when secreted in too large a quantity, occasions debility of the frame, and a desponding, inactive state of the mind. This disease often proceeds from obstructions in the liver, and a deficiency of bile; but it is in a superabundance of that fluid, with increased acrimony, where the water will prove of the greatest service: when accompanied with gall-stones, their passage will be best promoted by drinking the warmed water, with the proper use of tartarized antimony, nauseating doses of ipecacuanha, and the cautious employment of calomel.

In the dropsy, I have had no opportunity of judging of the power of the water. Three instances have been related to me, in which it was said not to have produced any good effects; still, from its being a strong diuretic, I should feel dis-

* Saunders on Mineral Waters.

posed to recommend it in the incipient symptoms of anasarca, and œdematous swellings of the feet, that originate in a disordered state of the liver, but not so as to interfere with the exhibition of more powerful medicines.

The water may be employed in many diseases of the urinary organs, that give rise to the formation of calculi and gravel, and after a long course of mercury, for the cure of venereal affections. It is more especially in these cases that the saline water should be administered in small doses early in the morning, and between breakfast and dinner, so as to keep the bowels regular, and promote the excretion of urine. Combined with milk, it has been prescribed in the hectic fever that attends pulmonary consumption, and found to allay the cough and troublesome dyspnœa usually attendant on that distressing complaint.

Another important use of the saline water is in removing the peculiar habit of body that predisposes to cutaneous eruptions and scorbutic disorders, "which cannot be repelled without exciting internal inflammation, and make their appearance at different periods in painful ulcerations on the skin, producing a copious acrid discharge of lymph, and

an abundant desquamation*.” Such complaints are often tedious in their progress, and require a patient trial of the water. Sometimes the eruptions and itching are increased for the first few days, but go off by the aid of a little cooling medicine.

In scrophula, the sea-water has certainly a decided preference, both on account of its greater strength, and the influence of the marine air, which contributes much to the invalid's recovery; although instances are not wanting where this water has effected a cure.

Hæmorrhoids, or piles, and fistula in ano, are more frequently to be regarded as constitutional than local diseases, and generally owe their origin to a full and plethoric habit, hepatic obstruction, or habitual costiveness. Experience has long determined the superior efficacy of saline purges, particularly when united with sulphur, over those of a more drastic nature. Here, then, the sulphureous and saline waters may be combined and taken, with the hope of producing a salutary change.

“Females who are suffering from a number of anomalous symptoms, occasioned by a suppression

* Dr. Saunders on Mineral Waters.

of the menstrual discharge, and women who have arrived at that time of life when this periodical evacuation begins to cease, and is followed by difficult respiration, febrile heat, irregular flushings, pains in the back, and swellings of the feet*," will derive benefit from the saline water at Llandrindod.

The water often gives immediate relief in the heartburn, and restores the tone and vigour of the stomach after it has been impaired by the intemperate use of food, or of spirituous liquors.

The stomach is much assisted in its energy by warm clothing and moderate exercise; and when, from diseased bones or other cause, this becomes impracticable, the patient should be carried about, or ride in an open carriage.

The diet should be nutritive, and rather generous; every kind of aliment that is heavy, and indigestible in its nature, or heating and stimulating in its quality, should be avoided. The quantity the stomach is capable of digesting, must never be exceeded; and water, or white wine and water, should form the common beverage at meals.

The saline water may be drank as soon as the

* Dr. Saunders on Mineral Waters.

weather will permit of early rising, and the use of exercise before breakfast; hence it is that the company rarely resort to Llandrindod before May, and continue there through the Summer months until the beginning of November.

The duration of the course must be regulated by the nature of the disease, and the effects of the water on the constitution. A shorter time than two or three weeks will scarcely justify the expectation of any permanent benefit; and it more frequently happens that it must be persevered in for four or five weeks, and sometimes for months, before the health is perfectly re-established.

In hot weather the journey to Llandrindod should be performed by gentle stages, otherwise an inflammatory disposition might be excited that would defeat the intended purposes of the water; and for the same reason it may be proper, on the arrival of the patient, to delay its employment for a day or two.

The water should always be left off in a gradual manner, and no alteration made in the diet for some time, to prevent the mischief that might ensue from a sudden discontinuance of the depleting system.

The saline water is well adapted for the purposes of a cold bath, and may be used, under the same restrictions as sea water, in all cases of general debility and nervous affections, that are unattended by any determination of blood to the head and chest, or internal inflammation, provided that the constitution is able to bear the shock of immersion, and to overcome the sedative powers of cold water; for when the patient is so debilitated as to be incapable of re-action, and remains trembling, pale, and inactive, bathing is a remedy of a dangerous nature.

Those who are of a strong and robust habit may bathe early in the morning, before breakfast; but, in general, weak and delicate people will derive the most advantage from going into the water about two hours afterwards.

The saline water should not be drunk on the days that the bath is used, and the frequency of its repetition must depend on the nature of the disease; it should not, however, be employed oftener than three times a week.

In ardent fever the cold affusion is limited to that stage of the complaint "when there is no sense of chilliness present, when the heat of the surface of the body is steadily above the natural standard,

and especially when there is no general or profuse perspiration*.”

The cold bath will be found an useful auxiliary to the rock water ; but it should seldom be had recourse to without the advice and concurrence of a professional gentleman, for some little preparation will almost always be required further than what can be stated in the general outline of direction.

* Dr. Currie on cold Affusion.

ANALYSIS

OF THE

Sulphureous Pump Water.

THERE are several springs of a sulphureous nature at Llandrindod, situated within a few yards of each other: one only of these is now used internally; the rest are employed as external applications.

The sulphureous water rises in a dingle about 100 yards north of the saline water, and its stream flows nearly in an opposite direction from north to south.

The soil is of a dark brown colour, and consists chiefly of the remains of decayed animal and vegetable matter, with strong traces of a ferruginous earth. It does not effervesce with the mineral acids; but is more favourable to vegetation than the soil upon the common.

Upon pumping early in the morning, the first portions of water are covered with a thin pellicle,

and often contain small pieces of sulphur, that have been deposited on the sides of the well.

This water varies much in its appearance; sometimes it is of a colour inclining to blue, and at others, perfectly clear and transparent.

It has a strong sulphureous smell, similar to the odour of addle eggs, or the washings of a gun barrel. To the taste it is slightly saline and nauseous, but habit soon reconciles the patient to its use.

It gives out a few bubbles of air, and leaves a halitus, or vapour, that obscures the transparency of the glass.

The water, in its course down the channel from the pump, deposits a black sediment, and white fibrous mucus, which was formerly preserved for the purpose of dressing of old wounds and ill-conditioned ulcers.

After standing for twenty-four hours exposed to the atmosphere, the water becomes rather opaque; it loses its sulphureous taste and smell, and becomes simply saline, even when secured from the air, the sulphur being disengaged from the hydrogen gas, and precipitated in a thin film on the sides of the vessel. The water should, therefore, be drunk at the pump, "more especially in cutaneous diseases,

where the sulphureous principle is particularly required:" vessels out of which this water has been constantly drank, or that have retained it for a short time, become coated with a black sulphureous sediment.

The water is much affected by heavy rains, and after some days of stormy weather, becomes very turbid. This circumstance is probably owing to the well, which is not sunk more than three feet, communicating with the neighbouring springs.

In the summer of 1816, the temperature of the water was generally 54°.

In May and the beginning of June, 1817, it was 52°.

In July, 1816, its specific gravity was 1009.5.

In September, 1005; and on the 31st of May, 1817, 1004.

The specific gravity of the water is, therefore, subject to some variation, and this may arise from the same cause that destroys its transparency in a rainy season.

Examination of the Sulphureous Water by Reagents.

Tincture of galls dropped into the fresh water occasions a light purple tinge, which, after some

hours, turns black : a flocculent precipitate falls to the bottom of the glass, and the water above acquires a yellowish colour ; but this change is not produced after the water has been boiled, or suffered to remain in the open air for a short time.

Prussiate of potash causes a light green tinge, which, after standing for half an hour, becomes shaded with a very faint cloud of blue.

Tincture of litmus was not perceptibly reddened, but had its blue colour slightly increased.

Tincture of Brazil wood, added to a pint of the water, was, after some days, precipitated of a dingy blue colour.

Turmeric paper was not altered.

Syrup of violets is in a few minutes rendered of light grass green, which gradually changes to a much deeper cast.

A solution of soap is immediately curdled.

Lime water is instantly rendered turbid, both before and after the water has been boiled.

A few drops of nitric acid preserve the transparency of the water, accelerate the escape of a few globules of air, and increase the sulphureous odour that proceeds from it.

Oxalate of ammonia discovers the presence of a large quantity of lime.

Nitrate of barytes gives no indication of the existence of combined sulphuric acid.

Nitrate of silver produces beautiful white circles streaked with blue, which as they descend through the water, become of an orange brown colour.

Nitrate of silver added to the boiled water, was followed by an abundant white precipitate.

Characters traced on paper with a solution of acetate of lead, become black and legible when steeped in the fresh water, or held over its surface, which indicates the presence of sulphuretted hydrogen, and accounts for the change which the water undergoes on being exposed to the atmosphere for a few hours, as well as for the sulphureous sediment found on the sides of the vessels in which it has been kept.

Bismuth is blackened by the fresh water, and polished silver is immediately tarnished.

The water is not in the least degree affected, either by tartaric acid, or the nitro-muriate of platinum.

Inferences.

From the foregoing experiments, the following inferences may be drawn.

That the water does contain the least possible

trace of iron, as indicated by the faint cloud of blue produced by the prussiate of potash, but in quantity infinitely too minute to be estimated.

That, in other respects, the water is similar to the saline, from which it differs only in the proportions of its solid ingredients, in being more fully impregnated with sulphuretted hydrogen gas, and containing less of carbonic acid gas.

Examination of the Sulphureous Water by Evaporation.

The odour of the sulphureous water is augmented by the action of heat; this may proceed from a greater volume of sulphuretted gas being driven off in a given time than when allowed to evaporate spontaneously.

When the water is boiled in metallic vessels, it is decomposed, and becomes of a yellow colour, from the influence of the sulphur on their surfaces.

A wine gallon of the water being evaporated to dryness, left a residuum of 308 grains.

A. This was digested in four times its weight of highly rectified spirits of wine for 24 hours; the solution was separated, and the salts that remained undissolved being washed with a little fresh spirit, were dried at 212° , and weighed 222.6 grains.

B. C. The 222.6 grains were digested with 12 oz. of distilled water, and the insoluble residue being collected, washed, and dried, weighed 6 grains.

	<i>Grains.</i>
<i>A.</i> Muriates of lime and magnesia....	85.4
<i>B.</i> Muriate of soda	216.6
<i>C.</i> Insoluble residue.....	6.
	—
Total.....	308.
	—

A. a. The alcoholic solution was evaporated to dryness, and the earthy muriates decomposed by sulphuric acid; the excess of acid was expelled by an increase of temperature; the sulphate of magnesia was carefully dissolved in a small quantity of cold distilled water, and the solution separated from the sulphate of lime, which was again washed with a fresh portion of water, and then boiled for twenty minutes in three times its weight of carbonate of potash; the sulphate of potash was washed off with distilled water, and the carbonate of lime saturated with pure muriatic acid, diluted with a little water; the muriate of lime was dried at 212°, and weighed

54 grains.

This being deducted from 85.4 leaves

31.4 grains

b for the muriate of magnesia.

B. a. The watery solution being evaporated to dryness, afforded

216.3 grains

of muriate of soda.

C. a. The insoluble residue scarcely effervesced with diluted muriatic acid; no lime could be detected by oxalate of ammonia; but with prussiate of potash, the solution gave a light blue tinge, and when that had subsided, yielded a very slight sediment of magnesia with the caustic ammonia; what remained undissolved, was vegetable matter.

It is very evident that sulphur is precipitated from this water, from the stain left in the vessels in which it has been preserved; but with regard to the proportion found after the process of evaporation, this varies considerably, for unless the degree of heat is far below the boiling point, the whole of it will be dissipated.

From these experiments, a wine gallon of the water contains, of

	<i>Grains.</i>
<i>A. a.</i> Muriate of lime	54
<i>b.</i> ———— magnesia	31.4
<i>B. a.</i> ———— soda	216.3
<i>C. a.</i> Vegetable matter, with a trace of iron and magnesia	6
	—
	307.7
	—
Loss muriate of soda	3
	—
Total	308.
	—

*Examination of the Gaseous Contents of the
Sulphureous Water.*

A glass flask, which with its syphon contained exactly sixteen ounces and two drachms, was filled with the fresh water, and gradually heated by means of a spirit lamp; the water expanded upon the first impression of the heat, the two drachms contained in the syphon, were suffered to escape, and deducted from the results of the experiment.

The boiling temperature was continued for the necessary length of time, and the gas received over mercury, the sulphuretted hydrogen that was not decomposed by the quicksilver, was absorbed by a hot solution of nitrate of silver, and the respective

proportions of the carbonic acid gas and azote were ascertained by means of lime water, to be, of

	<i>Cubic Inch.</i>
Carbonic acid gas	0.125
Azote	0.625
	.75.

when the barometer stood at 29.8°, and the thermometer at 58°.

Or, per gallon, of

	<i>Cubic Inches.</i>
Carbonic acid gas	1
Azote	5
	6.

To determine the quantity of sulphuretted hydrogen, the gaseous contents of sixteen ounces of the water were received over boiled water of the temperature of 100°, and, at the conclusion of the process, transferred into a hot solution of nitrate of silver. A diminution of bulk ensued, equal to

0.375 cubic inch ;

making for the total quantity of sulphuretted gas, per gallon,

3 cubic inches.

An idea having prevailed that the well, a few feet

to the right in advancing to the sulphureous water, was stronger than the one in use, I made some comparative experiments; and found, that

Syrup of violets did not reach so dark a green; neither did the nitrate of silver or acetate of lead, indicate so large a proportion of sulphur.

Upon evaporating down a wine pint of the water, I obtained a residuum of 40 grains, or 320 grains per gallon.

A wine gallon of the sulphureous water, yielded

	<i>Grains.</i>
In September, 1816	308,
and	
In June, 1817.....	316

of solid contents.

ON THE
MEDICINAL PROPERTIES

OF THE

Sulphureous Pump Water.

THIS water is much used for numerous disorders, and forms a valuable acquisition to Llandrindod; the quantity of sulphuretted hydrogen is certainly small, yet it is sufficient to give very decided sensible properties to the water.

Upon the commencement of a course, it occasions a slight fulness and giddiness of the head, which usually go off in a few days; the water greatly promotes the excretion of urine, but does not act upon the bowels so readily as the saline water.

Sulphureous waters were amongst the first noticed by the earlier writers, and accordingly we find various accounts respecting them, and many waters were suspected to contain sulphur in which it did not exist.

Ætius “ writing of natural bathes, wherein

brimstone is either the onely miner or matter of them, or chiefe matter thereof," gives us the following account of them, which he acknowledges to have received from Avicenna. "The bathes of brimstone soften the sinewes, swage the payne that a man hath in desiring to goe oft unto the stoole, and when he commeth he can either doe little or nothing, they scoure and cleanse the skinne, wherefore they are good for the white morpew and blacke, for the leprosie, and for all scabs and scurffes, for old sores and botches, for the falling of humors into the joynts, for an hardened spleen or the cake in the left side, for an hardened quother, for all kind of palsies, for the sciatica, and for all kinds of itch or itching, but the bathes of brimstone hurt the stomach and do marre it."

"Agricola, in his bookes of those things which flow out of the earth, writeth thus of bathes of brimstone."

"The bathes of brimstone doe soften the sinewes and doe heate, they are good therefore for palsie, for places pulled in too much or stretched too farre forth, for the shaking and trembling of any member, and they swage ache, and draw out swelling of the limmes, and drive and scatter them away; they are good therefore for the gowte in the hands,

for the goute in the feet, and for the sciatica, and other diseases in the joynts; they swage also the pains in the liver, spleen, and drive away the swelling of them both; they scowre away freckles, and heal morphews and scabs, but they undoe and overthrow the stomack*.”

It has been observed “that there is no form of combination, in which sulphur is so active and so readily diffusible as in that of union with hydrogen†;” and the success that has attended the use of sulphureous waters in many obstinate complaints, may with justice be attributed to this principle.

Waters impregnated with hepatic air possess a stimulating property; they are also diaphoretic and diuretic, and have been found very serviceable in chronic rheumatism, bilious complaints, and visceral obstructions, nor is there any good reason for supposing that they impair the tone of the stomach, when taken internally, or used in the form of a bath.

They have frequently been recommended for indigestion, when the bowels are loaded with a

* The rare Treasure of the English Baths, by William Turner, published in 1641, by William Bremer.

† Saunders on Mineral Waters.

viscid slimy matter; in diseases that proceed from leading too indolent and luxurious a life, in some asthmatic cases, in the gravel, in the scrophula and other diseases where the glands are swelled and obstructed, and have been esteemed amongst the best remedies for destroying and evacuating worms.

The drinking and bathing in these waters, more especially those of the hot kind, have been employed as effectual means of removing those evils which follow an injudicious use of mercury; and which often remain after the venereal taint is gone. They cannot, however, be taken in all cases with equal safety, and should be abstained from when there is much inflammatory action or febrile heat.

The stimulating effects of the sulphureous water at this place, are in a great measure obviated by the saline ingredients; and it is upon this account that many patients have derived advantage from it, more especially when united with an equal quantity of milk; in chronic coughs, and troublesome expectorations from the lungs, after they had experienced the simple sulphureous water at Llanwrtyd, to be too heating for them.

Like Harrowgate and Moffat, the sulphureous

water at Llandrindod has acquired a high reputation in the cure of a number of cutaneous eruptions, both applied externally, and taken as other waters; in a few days the sulphur pervades the whole system, transpires through the pores of the skin, and silver worn in the pocket becomes tarnished.

The water should be drank cold and fresh from the pump, when the stomach is able to bear it, especially in those cases where the sulphureous ingredient is particularly wanted, in glasses containing half a pint each; two or three of these may be taken in the morning before breakfast, at moderate intervals, and repeated about noon.

As a general rule, the patient may commence with two half pints, and in a short time the number may be increased to six or eight; if this quantity does not procure a determination to the bowels, the saline water should be taken two or three times a week, so as to prevent any unpleasant congestion.

The invalid will always derive most benefit from beginning with a small quantity, both as it affords an opportunity of observing the effects of the water, and of regulating the dose according to the influence that it exerts. It will also be proper to remove any

offensive matter from the digestive organs, by aperient medicines, previous to the commencement of the course.

In some cases, the total amount taken daily may be larger than what I have stated, and in general, the longer the course is expected to last, the doses should be smaller and more gradually augmented.

In several cutaneous diseases, when the intention is to overcome the morbid action of the skin, by the introduction of sulphur into the system, it will be most advisable to administer the water in small quantities, and to use the saline water occasionally, for the purpose of operating on the bowels. Thus the sulphureous principle will not be so liable to be carried off, and will find its way more readily into the circulation, which is probably a consideration of much importance.

The different combinations of mercury, and antimony, may often form a part of the plan of treatment for cutaneous disorders; and when they are found to resist the power of the water, and are become obstinate, the Plummer's pill, or the oxy-muriate of mercury, taken to the extent of one-eighth of a grain, twice a day, will frequently cause a change in the constitution, and promote recovery; but their employment must entirely depend on the

individual case, and cannot be left to the judgment of the patient.

The same observations that have been made on the duration of the course, and rules to be observed at the time of drinking the saline water, will apply here. The sulphureous water should never be drank at meals, or even for several hours afterwards. The regimen should be simple, and consist of meats plainly dressed; with vegetables, and the use of white wine and water. The patient should retire to rest early, and get up in the morning, taking more or less sleep, as he may require.

Sleep in the day-time, especially after dinner, ought not to be indulged in. Moderate exercise, and agreeable amusements, are absolutely necessary; but all such as heat or fatigue the body, or command too close an attention and application of the mind, are prejudicial.

The sulphureous water is much assisted in its efficacy by the aid of the warm bath; and upon the methods of using this, it may be proper to say a few words.

The bath is prepared by adding to the fresh water, a sufficient quantity of water that has been made hot, to bring it to the desired temperature; and, for this purpose, the vessels should be lined with

tin, as the sulphureous principle is less liable to be decomposed by that metal than any other.

The warm bath requires to be employed with some caution, on account of the determination that it occasions to the head.

It is decidedly a stimulus to the heart and arteries, more especially to the vessels of the skin; and the perspiration that it excites should be kept up for an hour, by confining the patient in bed, or in a warm room.

The sulphureous warm bath is of great service in "herpetic eruptions, attended with a constant desquamation of the cuticle in dry branny scales," in the scurvy, and many leprous affections; it gives relief in spasmodic diseases, and in contractions of the bowels, accompanied with constipation; in chronic rheumatism; in gouty complaints; in the hypochondriasis; and paralysis of the limbs.

By the increased action which the heat excites on the surface of the body, it relieves internal obstructions; and by the relaxation which it produces, very much facilitates the passage of biliary calculi. It allays nervous irritation, and induces sleep.

"The warm bath is, upon the whole, a safer remedy than the cold, and may be resorted to even

when there is a considerable degree of acute fever*.”

The bath may be used on the days of drinking the water, in the morning, at noon, or in the evening; but always upon an empty stomach; and of these, the morning is the most preferable.

The degree of heat must vary, according to the circumstances of the case, from 92° to 98°, and the temperature must be increased or diminished, as the nature of the disease may require. In general, a bath at the temperature of 92° Fah. will be most advantageous; but in “paralysis the heat may be as high as it can be conveniently borne†.”

The time of remaining in the bath must be determined by the age and constitution of the patient, and may extend from eight or ten, to twenty minutes.

The vapour bath can be made of a higher temperature than the water bath: it acts much in the same manner, viz. as a stimulus; and it relaxes the skin and system in general.

When the seat of debility and stiffness is local, and confined to a particular joint, great benefit will

* Dr. Saunders.

† Dr. Saunders.

be derived from pumping on the part, and the subsequent use of friction.

The slime, or mud, collected from the channel over which the water flows, has been esteemed as an outward remedy for old wounds and ill-conditioned ulcers; and this practice of dressing sores with the mud from particular waters, appears to be of very ancient date. *Much benefit* could not be expected from it, and certainly the curds (that are now substituted) obtained by boiling together equal parts of the sulphureous water and milk, form a more elegant application.

ANALYSIS

OF THE

Ffynon cwm y Gof, or Blacksmith's Well;

SOMETIMES CALLED

THE EYE WATER.

THE eye water issues from the same rock as the saline carbonated chalybeate, and forms a small well, rising from between the crevices of the rock, and discharging its waters into the brook. It has never been inclosed, and is subject to great alteration, both in its temperature and the proportion of its solid contents, from the influence of the atmosphere, and the vicissitudes of the seasons.

This water differs chiefly from the other springs, in containing *sulphuric acid* in a combined state, and in the quantity of muriate of magnesia, which exceeds that of the muriate of lime.

I expected to find a sulphate of iron and sulphate of alumina produced by the decomposition of the iron pyrites and aluminous schistus; but could not

discover that either of them entered into the composition of the water.

When taken up fresh from the well, the water is rather milky and opaque, it sends forth no air bubbles or perceptible smell. To the taste it is saline, and devoid of the briskness that makes the saline water so agreeable to the stomach.

In 1816, the temperature of the well varied from 60° to 64°.

The specific gravity of the fresh water was 1002.

Examination of the Eye Water by Re-agents.

With different re-agents the following habitudes were manifested:—

Tincture of galls produces no immediate change; but after some hours the water becomes of a dirty brown colour; a precipitate follows, and a thin iridescent pellicle forms on the surface.

Tincturé of litmus has its blue colour rather increased.

Syrup of violets is rendered slightly green.

Oxalate of ammonia instantly renders the water turbid, and discovers lime.

Nitrate of silver occasions white clouds, which become blue on exposure to the light.

Acetate of lead, when traced on paper, does not become discoloured; its solution produces a milky hue.

Lime water added to the water, obscures its transparency very quickly.

Concentrated sulphuric acid accelerates the escape of a few minute air bubbles, and produces a considerable opacity, which is succeeded by a white sediment, and the water again becomes clear.

Nitrate and muriate of barytes in the space of two or three minutes cause a soft white cloud; in about half an hour a precipitate subsides, which is not redissolved by the nitric or muriatic acids, denoting the presence of sulphuric acid.

The caustic alkalies give a copious white sediment of magnesia.

Inferences.

From these observations we may conclude:

That the water contains a trace of iron.

That a carbonated earth is present.

That the water suspends lime.

That muriatic acid exists in the water.

That *sulphuric acid* is present in a combined state.

That magnesia is also present.

That no sulphuretted hydrogen gas can be discovered, and that the quantity of fixed air is very minute.

Examination of the Eye Water by Evaporation.

A wine gallon of the water being evaporated to dryness, left a residuum, weighing 256.8 grains; it was of a brownish colour, and deliquesced rapidly.

A. This was digested with four times its weight of highly-rectified spirits of wine for twenty-four hours, when the solution was separated from the insoluble matter, which was washed with a little fresh spirit, and being dried at 212°, weighed 183 grains.

B. C. The 183 grains were digested in 12 oz. of distilled water for twenty-four hours, the residue was dried at 212°, and weighed 5 grains.

	<i>Grains.</i>
A. Muriates of lime and magnesia	73.8
B. Saline matter soluble in water	178
C. Insoluble matter	5
	—
	256.8
	—

A. a. The spirituous solution was evaporated to dryness, and the earthy salts decomposed and separated by means of sulphuric acid; the sulphate of lime was boiled with carbonate of potash; the sulphate of potash was washed off, and the carbonate of lime saturated with pure muriatic acid in the manner already described in the experiments on the saline carbonated chalybeate and sulphureous water.

The muriate of lime, dried at 212° , weighed

21 grains.

This being deducted from 73.8, leaves

52.8 grains

b for the muriate of magnesia.

B. a. The aqueous solution was evaporated down to a few ounces, and examined by means of crystallized carbonate of potash; no trace of an aluminous salt could be discovered, and no precipitation of magnesia was produced by the caustic alkalies. Muriatic acid was then added, until the colour of litmus was slightly reddened, and the existence of sulphuric acid detected by muriate of barytes; the water had therefore dissolved muriate of soda, combined with a small quantity of sulphate of soda, or Glauber's salt.

C. a. The insoluble matter was digested in a pint of hot water for two hours. The solution was

filtered, and essayed by muriate of barytes and oxalate of ammonia, without giving any signs of the presence of sulphuric acid or lime.

b. The residue was partly dissolved with effervescence in diluted muriatic acid, washed, and dried at 212°, it weighed

3.5 grains,

and was composed of vegetable fibre, with a few particles of finely divided clay, that were mechanically suspended in the water.

c. The muriatic solution gave a precipitate with oxalate of ammonia, and a faint blue with prussiate of potash, indicating lime and a trace of iron.

From these data, a wine-gallon of the water afforded, of

	<i>Grains.</i>
<i>A. a.</i> Muriate of Lime	21
<i>b.</i> ————— Magnesia	52.8
<i>B. a.</i> ————— Soda, and a little Sulphate of Soda	178
<i>C. b.</i> Vegetable Matter and Clay	3.5
<i>c.</i> Carbonate of Lime, and a Trace of Iron	1.5
	256.8

In June, 1817, when the weather was remarkably fine and dry, a wine-gallon yielded 272 grains.

Examination of the Eye Water by distillation.

A wine-pint of the water boiled until the whole of the gas was extricated, and the products received over mercury, yielded

0.875 Cubic Inch,

consisting, of

Carbonic Acid	0.125
Atmospheric Air	75
	<hr/>
	875
	<hr/>

or, per gallon, of

	<i>Cubic Inches.</i>
Carbonic Acid	1
Atmospheric Air	6
	<hr/>
	7
	<hr/>

This water is occasionally used as a collyrium, or wash, for weak and inflamed eyes, and I have been informed by some persons who drank it experimentally, that they thought it operated on the bowels in the same manner as the saline.

THE END.

CORRIGENDA.

Page 36, line 22 from the top, *for* Materiè, *read* Mataree.

Page 41, lines 12 and 14 from the top, *for* Lauchstad, *read* Lauchstadt.

Page 49. line 22. *for* "do deflagrate"
read. do not deflagrate.

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Page 1, lines 1 to 10, for the title, read "Introduction"
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