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EXTRACT

OF AN

# ANALYSIS

OF THE

# Mineral Waters

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# DUNBLANE & PITCAITHLY,

AND OF THE

COMPOSITION

OF THE

# BATH WATER, &c.

FROM THE TRANSACTIONS OF THE ROYAL SOCIETY OF EDINBURGH-

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JOHN MURRAY, M.D. F.R.S. EDINBURGH-Read Nov. 20. 1814.

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# EXTRACT

OF AN

# ANALYSIS, &c.

### DUNBLANE WATER. | PITCAITHLY WATER.

In an English pint.

Muriate of soda...21. 0 grs. Muriate of soda....12.7 grs.
Muriate of line....20. 8 ...
Muriate of line....20.2 ...
Sulphate of soda... 3. 7 ...
Carbonate of line 0. 5 ...
Carbonate of line... 9.5 ...
Carbonate of line... 9.3 ...
34.3

46.17,

With indications of the presonce of iron.

Aerial Ingredients.

Atmospheric air...0.5 cab.ig.

Carbonic acid cas.l.0......

The latest, and no doubt the most accurate, analysis of the Bath water, that by Mr Philips, gives the followsing view of its composition:—

#### In an English pint.

0 1	
Grains. Cubic Inches.	
Carbonic acid gas1.2	
Sulphate of lime9.0	
'Muriate of soda3.3	
Sulphate of soda1.5	
Carbonate of lime0.8	
Silica0.2	
Oxide of iron	

14.8 7

It has always been found difficult to account for the powers of the Bath waters, the ingredients which are obtained in its analysis being substances of little activity, and the principal ones, indeed, being apparently inert. Now, from these ingredients unquestionably no medicinal power of any importance could be expected. They are either substances altogether inert, or in quantities so minute, as, in the dose in which the water is taken, to be incapable of producing any sensible effect. Some have, from this circumstance, been disposed to deny altogether any virtues to these waters; but the reverse of this appears to be established by sufficient evidence, and what is still less equivocal, the injurious effects they sometimes produce, and the precautions hence necessary in their use, sufficiently demonstrate their active powers.

To account for these, therefore, various hypotheses have been proposed.

But considering the composition according to the preeeding view, the ingredients and their porportions will be, viz.—

#### In an English pint.

	Grains. Cubic Inches.		
Carbonic acid gas	1.2		
Sulphate of lime	5.2		
Muriate of lime	3.1		
Sulphate of soda5.5			
Carbonate of lime0.8			
Silica0.2			
Oxide of iron,0.0 T			

The view of the constitution of mineral waters stated above, enables us to assign to the Bath water a much more active chemical composition. There is every probability that muriate of lime is its powerful ingredient. The principal products of its analysis are sulphate of lime, muriate of soda, and sulphate of soda. The proportion of sulphate of lime is such, that part of it must pre-exist in the water; but part of it, there is reason to conclude, is a product of the analysis;—the muriate of soda is larger than what the analysis indicates. In other words, there exist in it—muriate of lime, sulphate of soda, and sulphate of lime; and, during the evaporation, the muriate of lime being acted on by a portion of the sulphate of soda, muriate of soda, and a corresponding portion of sulphate of lime are formed.

Muriate of lime, it is well known, is a substance of considerable power in its operation on the living system ; in quantities which are even not large, it proves fatal to animals. When taken to the extent of six grains, the quantity of it which, according to the preceding view, exists in a quart of the Bath water, it cannot be inactive. It is very probable, too, that a given quantity of it will prove much more active in a state of great dilution in water, than in a less diluted form; as, in this diluted state, it acts, when received into the stomach, over a more extended surface; and, besides this, whatever effect may be due to the high temperature of the Bath water, in aiding the operation of the minute portion of iron it contains, the same effect must be equally obtained in aiding the operation of the much larger quantity of muriate of lime. The conclusion, indeed, as to the importance of this effect, is much more probable with regard to the muriate of lime, than to the iron, for supposing the quantity of the former to exist in the Bath water which has been assigned, the dose of it taken in a quart of the water, is not far from its proper medium

does, and is at least equal to one half of the largest does which can be given, and continued, without producing irritation, while the dose of the iron is not the one hundredth of that which is usually prescribed. Under the circumstances, therefore, in which the muriate of lime is presented in the Bath water, it is reasonable to infer, that it must be productive of considerable immediate effect.

This speculation is farther not improbable, that, to produce its more permanent effects on the system as a tonic, it is necessary that it should enter into the circulation. In a dilute state of solution it may pass more easily through the absorbents, while, in a more contracted state, it may be excluded, and its action confined to the bowels. Hence the reason, perhaps, that in some of the diseases in which it is employed, serofula particularly, it has frequently failed, its exhibition having been in doses too large, and in too concentrated form. And hence it is conceivable, that in a more dilute state, as that in which it may exist in the Bath water—besides its immediate operation, it may produce effects as permanent tonic, more important than we should otherwise expect.

I may mention, in confirmation of this, that I found a nineral water, of considerable celebrity, in Yorkshire, that of Ilkley, and which in particular was held in high estimation as a remedy in scrofulous affections by several eminent medical practitioners, to be water free from all foreign matter, with the exceptions of very minute quantities of muriate of soda, and muriate of lime. I had an opportunity of observing, at the same time, proofs of its medicinal efficacy.

I may add, that the iron in the Bath water is probably not in the state of oxide, or carbonate, as has been supposed, but in that of muriate. The muriate of iron is the most active preparation; and, so far, increased activity may be given to the slight chalybeate impregnation, and some modification of power may even be derived from the combined operation of muriate of line and muriate of iron.

It deserves to be remarked that, in the most essential ingredients, the muriate of lime and the iron, the Dun-blane, and the Pitesithly waters are similar to the Bath water, only, with regard to the former ingredient, much stronger. The other differences are unimportant. The larger quantity of sulphate of lime, and the squal quantity of silica, in the latter, cannot be supposed to contribute any thing to its medicinal operation; the difference in the proportion of sulphate of soda is trivial, and the larger proportion of muriate of soda in the other waters may rather be an advantage, rendering them more agreeable to the taste and to the stomach. The principal

difference will therefore be that of strength, with regard to the most active ingredient, the muriate of lime. The quantity of this is so large that the tonic quality of the Dunblane or the Pitcaithly waters can scarcely be observed, and perhaps even scarcely obtained, their action being more peculiarly on the bowels. It is accordingly as a saline purgative that the Pitcaithly water has been celebrated, and it is principally in those diseases in which this effect is sought to be obtained that it has been used. The Dunblane water, from the similiarity of its operation, would no doubt be employed in diseases of a similar kind. But whatever advantage might be derived from this purgative effect, it cannot fail to be perceived that a different operation, not less useful, may be obtained from them.

If sufficiently diluted, so as to avoid altogether the cperation on the bowels, the stimulant operation on the stomach, and general system, might be exerted by these waters, similar to that of the Bath waters, and under this form they might prove useful in diseases very different from those in which they might otherwise be employed. As they would require too large dilution to reduce them to this state, the temperature of the Bath water might easily be given, by adding the requisite praportion of hot water, by which a greater similarity of operation would be obtained. And the Dunblane water, in particular, containing so much a larger proportion of iron than the Bath water does, the dilution requisite to give it the same strength, with regard to the muriate of line, would still leave an equal degree of chalybeate impregnation. If the preceding observations, therefore, are just, the Dunblane and the Piteaithly waters may be converted, in all the essential parts of the chemical composition, into a water similar to that of Bath.

From the preceding statement of their composition it is easy to discover how this may be done. To give the same proportion of the principal ingredient, the muriate of lime, the Dunblane water would require to be diluted with from six to seven parts of pure water; the same degree of dilution would bring it to nearly the same strength with regard to the iron :- If a part of it were diluted with this portion of water, about 35 grains of sulphate of soda would require to be added to render the composition, with regard to this ingredient, perfectly alike, if this were thought essential. The only remaining difference then would be the presence of about 2.8 grains of muriate of soda in each pint of the reduced Dunblane water, the deficiency of 5.5 grains of sulphate and 0.7 grains of carbonate of lime, and the absence of 0.2 grains of silicious carth, differences in all respects probably of no importance whatever. The simple expedient, indeed, of diluting one part of the Dunblane water with from six to seven parts of warm water (or if the sulphateof lime in a state of solution should be surposed to be passessed of any active power, with four or five parts) and adding, if the chalybeate impregnation were not found sufficiently active, a few drops of tineture of muriate of iron, would probably serve every purpose. And if sufficient confidence could be given to the substitution, on the part of those employing these waters medicinally, the Dunblane water, thus altered, might probably be taken with as much advantage as the Bath water in the diseases in which it has been found useful.

The Dunblane, or Piteaithly water, might be converted, we far as regards the saline ingredients, into a water similar to that of Cheltenham, by the addition of a little sulphate of magnesia to each quart of thewater, or more nearly by the addition of a little of the bittern of sea water; and where, in the use of these waters, a continued purgative operation is required, such an addition might always be made with advantage.

Inspected by Dr Murray.

Dunblane Sept. 1817 .- Extracted by J. L. Robertson.

It is to be observed that the quantity of a "tea spoonful" of the sulphate of magnesia was given verbally by Dr Murray; and of the bittern a quarter of a wine glass will be found a quantity sufficiently active in general.

#### SELTZER WATER.

A conversion may be made of the Dunblane water into one comprehending the virtues of that celebrated water, which are stated by Dr. Saunders very fully in his Treatise on Mineral Waters, and more summarily by Dr Murray, viz.

"It operates as an antacid and diuretic, and is productive of much benefit in all dyspeptic affections, in diseases of the urinary organs, and in those general affections of the system which require a mild tonic power." "There are few mineral waters which have acquired a higher reputation, and there are few," he adds, "that deserve greater-consideration from the real medicinal virtues it possesses."

"Such is the activity of this water that its medium dose is only half an "English pint."

# SELTZER WATER.

In an English pint.

Carbonate of magnesia.... 5.0
Carbonate of soda..... 4-0

Muriate of soda......17.5

Alunate of soda.....17.

#### CORRECTED ANALYSIS BY DR MURRAY.

#### In an English pint.

Muriate of soda..... 7.8

Carbonate of soda......10.3 dry, or 18 crystallised.\*

#### CONVERSION PRINCIPLE.

To make a substitute and near imitation of the Seltzer water, comprehending its principal virtues, one plant the Dumblane water will require to be diluted with four pints pure spring water:—To another pint of spring water one and a half drachms of crystalised carbonate of soda will require to be put to dissolve, and allowed to stand till clear, then to be added to the other 5 pints with agitation. It will be a little milky when first mixed, but will become quite transparent on standing. One and a half drachms of the bittern of sea water, in a liquid state, may be added to the whole, which will give the 5 grains muriate of magnesia in each pint of the Seltzer water in a dry state. As already stated half an English pint is the medium dose.

<sup>&</sup>quot; Vide Analysis.

It is to be remarked, that when the Seltzer conversion principle was mentioned to Dr Murray, he pointed out an improvement in the mode of mixing, and desired it to be annexed to the extract which he had given his permission to be printed, and made use of the water in that shape only the last season he attended the wells.

Other conversions and substitutes may be made now that the constituent principles of mineral waters are clearly ascertained by Dr Murray's celebrated Analysis of the Dunblane water, published at length in the Transactions of the Royal Society of Edinburgh, and the efficacy of mineral waters accounted for, which by the old process of Analysis, was at complete variance with the products given, but which uncertainty is now happily done away.

## Dr Saunder's Regulations in using the Bath Waters.

"The quantity taken daily, during a full course, by adults, is recommended by Dr Falconer not to expeed a pint and a half, or two pints;—in chlorosis, with irritable habits, not more than one pint is employed.

"The morning is constantly the time of taking the waters; and the daily allowance is generally divided into three portions, of which two may be taken before breakfast, at different times, and one afterwards." Analysis of the Dunblane Rock Spring, by Dr John Murray, Edinburgh, discovered Sept. 1st. 1821.

With about " of oxide of iron.

Dr Saunders states as follows :-

"If, therefore, we consider water either as the principal solvent of all the alimentary matter which the animal body receives from without, or as the basis of all the secretions and exerctions that perform particular functions, or as a large constituent part of the solids of every denomination; if we survey its agency as diffused through every tube of the complicated system of an organised body, or condensed into firm but flexible fibres, we shall have no hesitation in allowing it a high place among those important, but simple, materials out of which is formed the curious and interesting structure of every animated being.

"This, therefore, leads to one important property of water, that of being the basis of all the fluids that are perpetually circulating through every tube of every organised and living animal or vegetable."

## From Dr Murray's Analysis.

"Dunblane, as a watering place, would be possessed of considerable advantages, situated between the range of the Oehil Hills and the Grampians, it is well sheltered, and hence enjoys a mild atmosphere; and the soil, from being a bed of gravel for a number of miles around, is extremely dry, an advantage inestimable in a moist climate."

FINIS.

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