ANALYSIS OF THE BROW WELL.

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In the month of September, 1883, there appeared in one of the numbers of the *Dumfries and Galloway Standard* an article upon the Brow Well, written by J. Creighton Brown, Esq., M.D., LL.D., F.R.S., now Sir James Creighton Brown, respecting the purity of the water, and condemning it as unfit for use, quoting as his authority for so doing an analysis of the water made by Professor Dewar on the 14th August, 1883, to which was appended the following observation :—

“The analysis of the above water leads me to infer that the well is contaminated with sewage matter, and, in the interests of the community, ought to be closed until further investigation shows that the suspicion I entertain is not supported by a knowledge of the surroundings of the well.”

Mr. Dewar's unfavourable report upon this celebrated spa, in conjunction with Sir James Creighton Brown's letter, caused a general disappointment amongst its patrons, so much so, that it was decided to have another analysis of the water made; accordingly Mr. McDougall, of the *Dumfries and Galloway Standard*, had another sample of the water collected, and forwarded for analysis.

I may state that the greatest care was taken in collecting the sample that was sent, special precaution being taken that it should be a fair average specimen of the water flowing from the spring.

The sample was collected on the 5th October, 1883, by ex-Councillor Rodgers, of Dumfries, assisted by one of the staff of the *Dumfries and Galloway Standard*, who went to the Brow for the express purpose; and after all due precautions had been observed, so that the water should be in its normal condition, it was securely corked up, sealed, and dispatched to my laboratory, and arrived there on the morning of the 9th, and the analysis of it immediately commenced.

The spring has little head or projectile force as it issues from the ground, flowing at the rate of about 300 gallons in 24 hours, and whether the spring is of superficial origin or deep-seated I am unable at present to state; but I am inclined to be of the latter opinion, seeing that the surroundings of the spring are well calculated to create suspicion as to the purity of the water, for at the distance of about 60 yards there are four cottages, with pigstyes, middens, &c., &c., which have existed in the same spot for at least a century; and I am also informed that the slops and refuse from these cottages are thrown carelessly on the ground, being unprovided with any artificial system of drainage, so that the ground immediately surrounding them must be more or less saturated with decomposing vegetable and animal matter; however, the spring is permanent, and flows evenly and continuously, even in periods of great drought and hard frost; but fluctuates to some extent in accordance with the rainfall, and it is also sometimes covered by the salt water when there are exceptionally high tides.

The water issues from a deposit of porous sand, which rests on a bed of impervious clay, and people have been in the habit of drinking it with impunity, and even Robert Burns, towards the close of his life, spent nearly a fortnight at the Brow Well, where he bathed in the Solway, and is presumed to have drank of the spa, in a vain effort to recover health and strength, which gives the present analysis a significance that would not otherwise attach to it.

The dying bard returned to Dumfries on the 18th of July, 1796, and on the 21st of that month he breathed his last.

This connection of the little spa (almost unknown) with the fortunes of the death-stricken poet gives it a world-wide importance, although, apart from this, it possesses undeniable virtues of its own, and is second to none in the list of British sulphated chalybeate waters. The analysis made by Professor Dewar, and also by myself, will be seen by referring to the following table, wherein my results agree closely with those of Mr. Dewar's.

Direct results of analysis :—

(1000 parts contain)									
Cl	..	..	..	..	..	..	..	..	·01633
SO ₃	..	..	..	..	..	..	..	..	·23062
CaO	..	..	..	..	..	..	..	..	·08530
CuO	..	..	..	..	..	..	..	..	·00060
FeO	..	..	..	..	..	..	..	..	·06057
MnO	..	..	..	..	..	..	..	..	·06060
As	..	..	..	..	..	..	..	..	·00041
Al ₂ O ₃	..	..	..	..	..	..	..	..	·00077
P ₂ O ₅	..	..	..	..	..	..	..	..	·00122
I	..	..	..	..	..	..	..	..	·00042
K	..	..	..	..	..	..	..	..	·00265
Na	..	..	..	..	..	..	..	..	·01380
MgO	..	..	..	..	..	..	..	..	·04931
SiO ₂	..	..	..	..	..	..	..	..	·02980
CO ₂	..	..	..	..	..	..	..	..	·02531
Organic matter	..	..	..	..	..	..	..	..	·11800
									·63576

Traces of Barium and Strontium.

SEVERAL CONSTITUENTS IN COMBINATION.

				In 1,000 parts.	Grains per imp. gallon.	Dewar. Imp. gallon grains.
Ferrous sulphate	..	..	..	·10504	7·3528	7·13
Calcium	..	..	..	·20715	14·5005	21·29
Copper	..	..	..	·00120	0·0840	
Aluminum	..	..	..	·00256	0·1792	
Manganese	..	..	..	·00127	0·0889	
Magnesium	..	..	..	·07875	5·5125	
Ferric Phosphate	..	..	..	·00257	0·1799	
„ Arseniate	..	..	..	·00630	0·4410	
Potassium chloride	..	..	..	·00497	0·3479	
Sodium	..	..	..	·02308	1·6156	1·39
Magnesium iodide	..	..	..	·00049	0·0343	
„ carbonate	..	..	..	·04829	3·3803	7·38
Silicic acid	..	..	..	·02190	1·5330	1·96
Sodium silicate	..	..	..	·01268	0·8876	
Ferric oxide	..	..	..	—	—	4·44
Organic matter	..	..	..	·11800	8·2600	
Total solids	..	..	..	·63425	44·3975	43·79
Total by direct estimation	..	..	..	·63576	44·5032	43·79
AMMONIA IN 1,000 PARTS.						
Free	..	..	..	·01530		·0196
Albuminoid	..	..	..	·00050		·0011
Total	..	..	..	·01580		·0207

The water, besides containing the common constituents found in all springs, is rich in iron, containing more iron than several other springs of note, both British and foreign, and that in the form of ferrous sulphate. It also contains a large amount of calcium sulphate, along with a notable amount of magnesium iodide, arseniate of iron, and sulphate of copper, without containing other ingredients in excessive quantities, and its freedom from alumina renders it a very valuable water to those who are delicate and dyspeptic, and will prove an invaluable dietetic, giving tone and vigour to the stomach.

That the water contains a large quantity of sulphate of iron, without a corresponding quantity of sulphate of alumina causes it to stand at the head of the list of British sulphated chalybeate waters, and there can be no doubt that the medicinal use of this water by delicate persons, or those whose constitutions are exhausted or over-worked, would be beneficial, and they may derive relief and strength without the slightest fear of ultimate enervation.

As regards the free and albuminoid ammonia, it is entirely derived from vegetable organic matter, most probably from *crenic and aprocrenic acids*, acids which are not uncommon constituents of chalybeate waters such as the above.

I was prevented entering upon an exhaustive examination of the organic matter contained in the water, not having a sufficient supply for that purpose, but, at the same time, I do not consider it a deleterious impurity any more than any of the other constituents of the water.

When I had completed the analysis, I reported to my clients that I had no hesitation in stating that I was decidedly of opinion that the water was not contaminated with sewage matter, and for the following reason: that it was absolutely free from *nitrates and nitrites*, and that the *chlorine* was of normal quantity.

The oxidation of animal matter in water, and especially in contact with, or filtration through, soil, is most rapid, and yields abundance of nitrates and nitrites; vegetable matter, on the other hand, under like circumstances, is slow, and yields *none or mere traces* of these compounds. The normal chlorine, and the total absence of *even traces* of nitrates and nitrites, proving, conclusively, the absence of sewage contamination.

CONCLUSION OF THE SOCIETY'S PROCEEDINGS.