

Proposed supply of water to the town of Maidstone, in the county of Kent : reports on the microscopical and chemical examination of the filtered water of the River Medway, as supplied to the asylum near Maidstone, and of water from a well supplied by chalk springs, situated at Lidsing-Green / by Dr. Lankester and Dugald Campbell.

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(34.)

PROPOSED SUPPLY OF WATER
TO THE
TOWN OF MAIDSTONE, IN THE COUNTY OF KENT.
REPORTS ON THE MICROSCOPICAL AND
CHEMICAL EXAMINATION
OF THE
FILTERED WATER OF THE RIVER MEDWAY,
AS SUPPLIED TO THE ASYLUM NEAR MAIDSTONE,
AND OF
WATER FROM A WELL SUPPLIED BY CHALK
SPRINGS, SITUATED AT LIDSING-GREEN.
BY DR. LANKESTER, M.D., F.R.S., & DUGALD CAMPBELL, Esq., F.C.S., &c.

*Report on the Microscopic Characters of two Specimens of Water
from Maidstone, by EDWIN LANKESTER, M.D., F.R.S.*

8, Saville Row, July 26th, 1858.

On the 12th July, I received from Mr. Homersham two bottles of water, labelled, "Filtered River Water from Asylum, July 10, 1858, 11-12 o'clock; Temp., 58 deg. Fahr." The water was contained in quart stoppered bottles and sealed, and the labels were signed with the initials "J. G. Jr." On the 14th of July, the temperature of the water being 69 deg. Fahrenheit, I carefully collected the sediment formed in one of the bottles, and examined it under the microscope. I found it presented:—

1. Irregular masses of organic matter, having too indefinite ; character to indicate their origin in either plants or animals. They probably belonged to both.
2. Spores of Confervæ.
3. Unicellular Algæ. Forms of Protococcus, Diatomaceæ, and Desmideæ were all recognised.
4. Infusorial Animalcules. Amongst them were recognised Actinophrys Sol, and a species of Amphileptus.
5. Rotiferæ or Wheel Animalcules. Of these two species were observed.
6. Amongst the decaying vegetable matter were observed specimens of the lower forms of Annelida, which are frequently found inhabiting the mud of rivers and ponds.

The sediment of the remaining water was again examined after exposure to the sun light for two days, and the same forms of plants and animals were recognised, but in smaller quantity.

The presence of so large a number of forms of animal and vegetable life, indicate a water exposed to the influence of, and containing decomposing animal and vegetable matter. Such waters may not be injurious to life as long as they contain sufficient oxygen gas to oxidate the animal and vegetable matters they contain during their decomposition. But they are exposed to two causes by which the process of oxidation may be suspended. The first is the accumulation of the animal and vegetable matter to such an extent as to prevent their oxidation, when gases and compounds are formed in the water highly injurious to health. Such an accident may occur in the storing or keeping such water in uncleaned butts or cisterns, or in an increase of the supply of the organic matter from its original sources. The increased supply of the sewage from London to the Thames is the cause of the

present condition of that river, and this may be the state of any river water which receives the sewage of towns.

In the second place such water may be rendered impure by the loss of its oxygen gas. At a temperature of 50 deg. water holds a much larger quantity of oxygen gas in solution than at 70 deg., consequently at this latter temperature the water may lose the quantity of oxygen gas necessary to oxidise the organic matters it contains, and putrefaction and the discharge of injurious gases will ensue.

On the 22nd of July, I received from Mr. Homersham a quart bottle, sealed and labelled, "Maidstone, W.W., July 20th, 1858, Lidsing Green, quarter past two o'clock. Temperature, 50½ deg. Fah. J. Glynn." This water was examined four hours after its arrival. It was very clear and bright, and afforded no deposit that could be seen by the naked eye. On placing it in clean glass vessels by the side of the "Asylum" water, it was at once seen to be much brighter. On pouring off the water I could obtain no deposit exhibiting any form of vegetable or animal life. The only objects presented under the microscope, were a few very minute crystals of carbonate of lime.

This water was exposed to the light at a temperature varying from 64 deg. to 67 deg. Fah. for 48 hours. The water was then carefully decanted off till an ounce was left. This was put into a wine glass and again carefully decanted till a few drops were left, and on placing this under the microscope I could detect no trace of organic matter either living or dead. I infer from this fact that the water coming from "Lidsing Green," has no organic matter in it at all; that water from this source must be pure; that organic matter cannot accumulate in it, for it is derived from a source where neither living nor dead animal or vegetable matter can exist, and that from the same cause it could not be

rendered putrescent were it exposed to a temperature which should drive from it all the oxygen which it contains. Such a water as this is perfectly safe for drinking purposes, and a heavy responsibility would rest on those who would supply the inhabitants of a town with water containing decomposing organic matters, when water so pure as this could be obtained.

Independent of the above examination, which proves the great superiority of such well or spring water for drinking and dietetical purposes, I would draw attention to the general fact, that river waters receiving the sewage of towns, and the washings of manured lands, are liable to special contaminations, which may become the sources of serious disease. Thus it is well known that the ova of the various forms of worms that inhabit the human body may be washed into rivers, and thence conveyed into the human system, where they find their proper seat for development, and during their growth produce those forms of cystic worms, which are more dangerous in their effects than the parents from which they have been derived. Recent researches have also shown that, under certain circumstances, the impure fœcalized waters of rivers have exerted a most powerful influence, either in producing or predisposing, to attacks of epidemic cholera. This was clearly shown in the case of the water supplied to the district of Lambeth, from the Thames, in the year 1854, where the inhabitants of houses supplied with fœcalized water from an impure part of the Thames, died from cholera in the proportion of three and a half to one as compared with inhabitants living in the same district supplied with the same water, but taken from a less impure source.

But even well waters, where obtained from populated districts, may be exposed to contamination from adjoining cesspools, and the shallow well waters of the metropolis and many of

the towns of England so contaminated have been known to produce the most disastrous results. Under these circumstances, undoubtedly the safest source of supply of water for domestic use is *deep* well or spring water, obtained from districts free from all possible contamination with fœcal or other impure matter. Such water is frequently hard, from the presence of bicarbonate lime, especially when obtained in chalk and limestone districts, but this defect may be most certainly and surely remedied by the application of the softening process invented by Dr. Clark, of Aberdeen.

S. C. HOMERSHAM, Esq., Civil Engineer,
19, Buckingham-street, Adelphi, London.

Report on the Chemical Examination of a Sample of the Filtered Water of the River Medway, as supplied to the Asylum, near Maidstone, Kent, and of a Sample of Water from a deep Well supplied by Chalk Springs situated at Lidsing Green, by DUGALD CAMPBELL, ESQ., F.C.S., Analytical Chemist to the Brompton Hospital, &c.

7, Quality Court, Chancery Lane, London,
July 27th, 1858.

SIR,—I have submitted to Chemical examination the two samples of water which were left with me by your instructions, and beg to report as follows :—

The Filtered Water of the River Medway, from the Asylum, when taken, July 10th, 1858, from 11 to 12 o'clock in the day, was at a temperature of 58 deg. Fahrenheit, and, although without any unpleasant taste, it has a slight yellowish tinge from dissolved vegetable organic matter. On standing for a short time it is found to deposit a very small quantity of a light reddish matter, which consists principally of sesquioxide of iron, with a little organic matter, chiefly of a vegetable origin. After depositing the above matter, the water has still the same yellowish tinge.

The total solid contents per imperial gallon of 70,000 grains, at 60 deg. Fahr., were found to be 14·16 grains. Consisting of—

Mineral matter 12·00 grains.

Volatilized organic matter..... 2·16 „

14·16

Degrees of hardness by soap test 6·41

The mineral matter consists mainly of carbonate and a little sulphate of lime, with chlorides of sodium, potassium, and magnesium, likewise silica, and a trace of sesquioxide of iron—usual mineral substances found in river water.

On heating the solid contents to redness a considerable blackening was noticed, indicating the charring of organic substances.

By prolonged contact with lead, this water was found to corrode it, and dissolve it also in a slight degree.

The Lidsing-Green Well or Spring Water, when taken, July 20th, 1858, at half-past two o'clock in the day, was at the temperature of 50½ deg. Fahr. It has a fresh pleasant taste, is remarkably free from colour, and on standing exhibits no deposit.

The total solid contents per imperial gallon of 70,000 grains at 60 deg. Fahr., were found to be 30·56 grains. Consisting of—

Mineral matter	29·44 grains
Volatilized matter	1·12 „
	<hr/>
	30·56
	<hr/>

Degrees of hardness by soap test..... 16·67

The mineral matter consists chiefly of carbonate of lime, with traces of sulphates of lime and magnesia, also chlorides of sodium and potassium with silica, and a minute trace of sesquioxide of iron—usual mineral matters in water from the chalk.

After submitting this water to the well-known liming or softening process of Dr. Clark, so successfully in use for the last four years at the Plumstead Water Works, and which simply removes from the water 2 grains of chalk per pint, without leaving anything else in the water in the place of the removed chalk, it was found to be as follows :—

Total solid contents per imperial gallon of 70,000 grains at 60 deg. Fahrenheit, 14·88 grains ; consisting of—

Mineral Matter.....	14·00 grains.
Volatilized Matter	0·88 „
	<hr/>
	14·88
	<hr/>

Degrees of hardness by soap test..... 2·08

In order to make 100 gallons of each of the three waters as soft as distilled water, we would have to add of soap nearly in the following proportions :—

	Curd Soap.	Pale Soap.
River Medway Water filtered	11½ oz. ...	13¼ oz.
Spring Water from Lidsing-Green	30¼ oz. ...	34½ oz.
The same softened	3¼ oz. ...	4¼ oz.

On heating the solid contents of this water obtained both before and after softening, but especially the latter, very slight charring is observed, indicating the absence of organic substances.

Although this water is extremely soft, being only 2.08 degrees of hardness, it has no action upon lead, either to corrode or to dissolve it, even by prolonged contact.

The oxygen gas was found to be high in this water, being 50 per cent. more than in the filtered river water.

From these results it will be seen that the Lidsing-Green Well or Spring Water is capable, by the softening process of Dr. Clark, of becoming a water admirably fitted for all culinary, household, and manufacturing uses. Its temperature at its source is the average or mean temperature of the seasons (about 50 deg. Fahrenheit), and will be found to vary scarcely at all throughout the year. It is fresh to the taste, bright and colourless to the eye, soft and pleasant to the touch.

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