

*Analyses of the alum waters*

*42*

ANALYSES

OF THE

ALUM WATERS

OF THE

Jordan Alum Springs

BY

PROF. J. W. MALLETT,

Of the University of Virginia,

AND

REPORT OF THEIR MEDICAL VALUE

BY

DR. H. R. NOEL,

Of Baltimore, Md.

SURGEON GEN'L'S OFFICE  
263.  
LIBRARY

CHARLOTTESVILLE, VA.:  
CHRONICLE STEAM PRINTING HOUSE.  
1875.

JORDAN  
**ROCKBRIDGE ALUM SPRINGS,**  
**ROCKBRIDGE COUNTY, VA.**

---

**RESULTS OF THE ANALYSIS**

*Of five specimens of Alum Water from Jordan Alum Springs, Rockbridge County, Va., by PROF. J. W. MALLET, University of Virginia.*

Of the six basins or pools of alum water (numbered from left to right along the base of the cliff of shale) the contents of five were selected for complete examination, it having been ascertained that the water in No. 1 was of the same general character as the rest, but weaker.

The quantity of water is quite large, the pools holding many barrels each, and being found well filled up when the specimens for analysis were collected, on May 22nd, 1875, after a period of several weeks of dry weather broken by but one very light shower.

The temperature of the air in the shade was on the day named

81°.2	F.	at 9 A. M.	83°.6	F.	at 11 A. M.
84°.7	F.	at 10 A. M.	86°.5	F.	at 3 P. M.

The temperature of the water in the various basins was, on the same day:

	No. 2	No. 3	No. 4	No. 5	No. 6
At 9 A. M.	55°.8	57°.5	58°.6	58°.8	56°.2
At 11½ A. M.	56°.4	58°	59°.2	59°	56°.5

These figures are all above, and to a variable extent above, the mean annual temperature of the locality, showing the effect of surface exposure.

The water was in all cases clear and colorless, without smell, but having a more or less strong astringent and acid taste. The taste was decidedly most marked in the case of No. 4, and least so in Nos. 2 and 3. The water reddened litmus immediately, the color being deepest in Nos. 5 and 6, least in No. 3. Tincture of Galls, potassium fero-cyanide and ferrid-cyanide, and barium chloride gave precipitates in all cases, but of different amount—largest in No. 4. A visible deposit of copper upon a sewing needle was obtained in half an hour from No. 4.

The quantity of iron present as a ferrous salt was determined on the spot.

No gas is given off in bubbles, but the gases in solution were collected and examined.

The sediment in the pools, aside from mere earthy and sandy matter mechanically washed down, consists essentially of basic ferric sulphate.

The specific gravity of the water from the several basins was found to be

No. 2	No. 3	No. 4	No. 5	No. 6	at 60° F.
1.000473	1.000380	1.002477	1.001125	1.001176	

The following are the results of analysis. With a view to easy comparison with the valuable analyses by Col. M. B. Hardin,\* at the Virginia Military Institute, of the waters from the adjoining property, known as the "Rockbridge Alum Springs," the statement is made upon the basis of the "wine gallon," of 231 cubic inches, instead of the "imperial gallon" of 277.276 cubic inches, and the same assumptions are made as by Prof. Hardin as to distribution of acid and basic ingredients, about which in fact there can be little question in reference to these waters—containing, as they do, almost exclusively sulphates. The order in which the constituents are mentioned has been altered somewhat, so as to name the more abundant substances first:

## Grains in one wine gallon.

	No. 2	No. 3	No. 4	No. 5	No. 6
Aluminum sulphate.....	11.2035	6.8791	81.0528	26.1115	27.8462
Iron per-sulphate (ferric sulphate)..	1.4327	1.8441	5.1710	2.4288	2.8733
Iron proto-sul. (ferrous sulphate)...	.2931	.2256	.5167	.2243	.3150
Sulphuric acid (free).....	2.0666	2.1408	4.8425	7.9016	5.3201
Manganese sulphate.....	.1236	.3074	1.0232	.5679	.5328
Nickel sulphate.....	.0983	.1265	.4638	.2641	.4077
Cobalt sulphate.....	.0762	.0925	.3141	.3108	.3064
Zinc sulphate.....	.0684	.0307	.6078	.2143	.2819
Cadmium sulphate.....	trace	trace	.0321	trace	.0045
Copper sulphate.....	.1238	.1116	6.0752	2.3247	3.1042
Calcium sulphate.....	.3201	.2874	3.3079	3.0081	1.8420
Magnesium sulphate.....	3.1453	2.6517	9.2241	5.3647	8.2133
Potassium sulphate.....	.3217	.2468	.2712	.3025	.3256
Sodium sulphate.....	.2450	.1868	.2322	.3218	.2414
Lithium sulphate.....	.0024	.0056	.0172	.0108	.0097
Sodium chloride.....	.0084	.0072	.0823	.0631	.0406
Calcium fluoride.....	trace	trace	trace	trace	trace
Calcium phosphate (tribasic).....	.0027	.0036	.0138	.0084	.0079
Silica.....	2.0043	2.7961	3.0275	3.3036	3.4166
Organic matter.....	trace	trace	trace	trace	trace
Total .....	21.5361	17.9435	116.2754	52.7310	55.0892

The gaseous contents of the water were found to be :

## Cubic Inches in one wine gallon.

	No. 2	No. 3	No. 4	No. 5	No. 6
Carbon dioxide.....	11.22	11.39	10.38	9.91	11.08
Nitrogen.....	3.76	3.62	3.19	3.33	4.04
Oxygen.....	1.33	1.27	1.11	1.35	1.62
Marsh gas.....				trace	
Total.....	16.51	16.28	14.68	14.59	16.74

While the constituents of these waters are essentially identical with those of the adjoining "Rockbridge Alum Springs," and the variation in proportions observable at both places under varying conditions as to rain, &c., renders any minute discussion of results of little value, it may be noted in general terms that we have represented above alum water of three very different degrees of concentration—No. 4 being much the strongest, Nos. 5 and 6 of intermediate strength, and Nos. 2 and 3 weakest. Individual points of distinction are also observable, such as the larger relative amount of magnesium in No. 6, and of free sulphuric acid in No 5.

\* To whom is due the discovery of the presence in these waters of so many sulphates of the less common heavy metals. To the list of these sulphates the present investigation shows that that of cadmium must be added.

The very considerable quantity of copper present can hardly be without therapeutic significance, although this, as well as other constituents, is doubtless subject to variation in amount at different times, since a sample of the strongest water from the "Rockbridge Alum Springs" taken on the same day with above specimens, also gave a distinct metallic deposit upon a sewing needle in half an hour, though the specimen formerly analyzed by Prof. Hardin contained but little cupric sulphate. The occurrence of a not inconsiderable portion of the iron as ferrous sulphate, while most of the analyses of Professor Hardin show ferric sulphate only, is no doubt due to the specimens examined by him having been sent to him at a distance, while the results here given were obtained upon the spot. In the dissolved gasses the occurrence of oxygen (derived from the atmosphere) in less than normal proportion to nitrogen, (namely, 1 : 2 when in solution in water,) obviously arises from the oxidation of pyrites, whence the sulphates are produced.

J. W. MALLET.

---

## REPORT

*On the Medical Value of the Waters of the Jordan Alum Springs, by DR. H. R. NOEL, of Baltimore, Md., for six years Resident Physician at the Rockbridge Alum Springs (Frazier's).*

[From Baltimore Bulletin, August 7th.]

In the *Bulletin* of date July 17 was published for the first time an analyses of the waters of six springs recently opened at the Summer resort known as the Jordan Rockbridge Alum. The analysis were made by an eminent chemist, Professor J. W. Mallet, of the University of Virginia, and are therefore beyond all question or criticism; but the results given are so very different from those of the analyses of other alum springs that they deserve a most careful consideration and study by the medical profession.

The constituents are nearly identical with those of the old Rockbridge Alum, but the amount of solid element per gallon in one of the new springs is more than double and contains an unusual element in a very large quantity—viz.: the sulphate of copper, 6 grains to the gallon. There is also a large quantity of free sulphuric acid, which acid is only found in this free condition in the various alum springs of Virginia, Oak Orchard Acid Springs, New York, and the Tuscarora Acid Springs, Canada. In these springs, and very markedly in No. 4, is found manganese, a substance rarely seen in the analyses of mineral waters. The comparative strength and true value of each spring can only be obtained by a careful examination of the analyses of Prof. Mallet.

It will be seen that Nos. 2 and 3 are the weakest, and, in fact, correspond very closely with springs Nos. 2 and 4 of the old Alum near by—or the old Rockbridge Alum; while Nos. 4, 5 and 6 are rich in alum, iron, copper, &c. From the well-known medicinal action of the waters of the old Rockbridge Alum Springs, we can readily assign to Nos. 2 and 3 of the Jordan Alum their proper position, and can also say that they may be used with safety in comparatively large quantities, from one-quarter to one-half of a goblet full four or six times a day by persons just arriving at the springs. They contain enough of alum, iron, magnesia, potash and soda to act as an excellent tonic, alterative and astringent. No. 3, containing the smallest proportion of alum, would be best suited to those cases where the astringent action was not desired, but only the tonic and alterative action of the iron, soda, potash, magnesia, &c.

In large doses, that is, from two-thirds to a glassful, once or twice before breakfast, No. 3 would act as a cathartic and the effect would be intensified by the addition of a few grains of table salt, or ordinary soda. In small amounts, that is, from one to two wineglassfuls, it would, if repeated every few hours, act as a good diuretic, and would be the spring best adapted to the relief of inactivity of kidneys, &c.

No. 2 is more powerful, and would be in small doses an astringent and tonic; it would be of service in chronic catarrhs of the stomach, intestines, bronchial tubes, &c.; in chronic diarrhœa, chronic dysentery, chronic bronchitis, and in scrofulous affections its action would be that of an alterative and a gradual and progressive improvement be produced. In the moist eruptions of children, and chronic affections of the eyelids, the two springs would be specially applicable. In debility, anæmia, acid dyspepsia, and a general want of tone in the system, these waters would furnish the proper medicinal elements for improving the strength and enriching the blood.

“A pale, flabby, broad and teeth indented tongue, indicates almost always the need of large doses of the astringent preparations of iron.” “Owing to the astringency of iron salts, it is a useful practice to combine with each dose some mild laxative, as a few grains to half a drachm of sulphate of magnesia, soda, or potash. Some consider that the laxative markedly promotes the absorption of the iron.” (Ringer’s Therapeutics)

This being true, it is easily seen why these waters should be so admirably adapted to the condition of anæmia and debility, so often seen in young girls and in women broken down by nursing, &c., since they are not only astringent but contain with the iron, the magnesia, soda and potash which Ringer thinks promotes absorption of the iron.

In all affections of the stomach and intestines, where direct astringent action upon mucous membrane is desired, these waters should be taken fasting; in other affections, especially of distant organs, where alterative action is indicated, they should be taken after meals, for their absorption is greatly increased by intimate admixture with food during digestion. In cases of *anæmia*, thin blood, they should be taken before and after meals, but chiefly after. In many cases of gouty troubles, these waters exert a most remarkable influence, and patients improve with astonishing rapidity, due apparently to the improvement of the digestion and to

the action of the magnesia, soda and potash upon the liver and kidneys.

In regard to springs Nos. 4, 5 and 6, the immense amount of alum, iron and copper precludes their use, save by the special direction of a physician fully cognizant of the condition of the patient. These waters are indeed medicines, and as such must be administered under the care of an experienced hand. They cannot be taken by the half or even quarter of a glassful; so powerfully astringent are they and so much copper do they contain that a half a tumbler would in most persons produce at once nausea, if not vomiting; but in chronic ulcers of the stomach and ulceration of the bowels, such as so often found in long continued cases of diarrhœa and dysentery, they give excellent results. In the exhausting diarrhœa of consumption, where there is tubercular ulceration of the bowels and watery and mucous discharges, they are among the best of medicines. In chronic nasal catarrh, used with a nasal douche, their local action upon the membrane of the nose is in most cases extremely gratifying. The secretion lessens, the pain gradually subsides, and in a few weeks the patient is much relieved, if not cured.

In sore throat of the variety known as the clergyman's sore throat, *i. e.*, chronic pharyngitis, it is found that No. 4 gives an efficient gargle, and relieves to a great extent the congestion and inflammation. In chronic bronchitis it can be used as a local application, by means of a spray apparatus, or atomizer, and gives good results.

The action of these waters, both locally and upon the constitution, generally requires time, and, therefore, those using them must decide to persevere for weeks in their use if they desire permanent results.

To what extent Nos. 4, 5 and 6, with their large percentage of copper, iron, &c., may yet be applied in practice remains to be seen, and their application to other diseases must be the cautious investigation of the resident physician of the Springs. Certainly he has under his administration one of the most powerful mineral waters of the United States; the determining of its full therapeutic value will be a most valuable acquisition to medical science.

H. R. NOEL.