SANDER (E.)

NOTES ON LITHIUM.

BY ENNO SANDER, PH.D., PH.G.

LATE PROFESSOR OF MATERIA MEDICA AT ST. LOUIS COLLEGE OF PHARMACY; EX-PRESIDENT OF THE AMERICAN PHARMACEUTICAL ASSOCIATION, ETC.

REPRINTED FROM
THE JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION,
OCTOBER 27, 1894.

523.

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CONTAINING ALSO A DESCRIPTION OF VARIOUS LITHIA WATERS

MANUFACTURED BY THE

ENNO SANDER MINERAL WATER COMPANY,

ST. LOUIS.

CHICAGO:
AMERICAN MEDICAL ASSOCIATION PRESS,
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NOTES ON LITHIUM.

When Augustus Arfvedson, a Swedish student at Upsala, presented to his friend and teacher, the celebrated Berzelius, the new substance that he had separated from the rare granitic mineral *petalite*, found at the mines of Utoë in Sweden and which he had determined to be an alkali, he requested Berzelius to suggest a suitable name for it. After much thought, they finally decided to call it lithium (Greek, *lithos*, a stone), because it was the first alkali that had been obtained directly from the mineral kingdom.[1]

Lithium, symbol *Li*, the elementary substance, appears as a silver white, soft metal, whose specific gravity is only 0.59 or about six-tenths the weight of water; it is consequently the lightest of known metals. Its chemical equivalent is 7, and its atomic volume 11.9. In the spectrum it is recognized by a beautiful bright red line.

While lithium does not occur free in nature, it is found in a certain class of micas, ingredients in the primordial rocks,[2] in company with its congeners, potassium and sodium. The composition of these micas is more or less definite and consists, in the main, of aluminium, the alkalies (lithium, sodium, potassium, and even caesium and rubidium), small quantities of iron, and manganese combined with silica and fluorine. Where, however, aluminium is replaced by iron or manganese or both of them, phosphoric usually replaces the silicic acid; as, for instance, in amblygonit, lithiophilit, triphylin, etc. The lithia micas which are found in the granitic

rocks of New England have been fully described by F. W. Clarke, of the United States Geological Survey,[3] whose report contains also a number of analyses of the most important specimens. They are met with all over the world, although seldom in sufficient quantities to render the extraction of lithium profitable. These granitic rocks become gradually disintegrated under the combined influence of water and the atmosphere with their accompanying gases, and the ingredients rendered soluble by the influences named are leached out, and the solutions stored up to reappear in mineral springs. These, flowing into brooklets and thence into rivers, finally reaching the ocean, permeate the alluvial soil, and from this are taken up by growing plants. From the latter they pass into the animal organism, and thus it is that mineral constituents, like lithium, are distributed throughout nature, organic and inorganic. Sometimes they occur in such minute quantities that their presence is discoverable only by means of the spectroscope, that wonderful instrument by which we are enabled to analyze the light of the fixed stars and declare their constituent elements, though the agency through which the message comes to us, light, may have been thousands of years on its way.

Although the minerals, in which lithium occurs, are found in the primordial rocks of almost every region of the earth, they occur but sparingly, generally in small masses, embedded in the granitic rocks, which carry very small proportions of lithium, from a mere trace to, at the utmost, 10 per cent.

It is not the intention of the writer to enumerate in this paper the various minerals in which lithium has been found, nor to give its percentage in these minerals; however, it may be interesting to the reader to know that a large percentage of them are found in the New England granites; but, as has been stated, in few of them only does the element occur in such quantities as to make them commercially available in the production of lithium salts. The same

is true of the most of the European granites. Two of these minerals only appear to be thus available, triphylin and lepidolith. Triphylin is a mineral in which the alkaline and metallic bases are combined with phosphoric acid. It is found in large discrete masses in the granite of Rabenstein in Bavaria, and is easily decomposed and well adapted to the manufacture of lithium salts.'

The bases in lepidolith are combined with silicic acid. It occurs principally in the decomposed granitic masses of Bohemia and Moravia. Since its discovery the world has drawn from this source its principal supply of the salts of lithium.

Filsinger [5] describes the processes used by Schering in the preparation of lithium carbonate, including the treatment of the mineral, which are very similar to the methods of H. Müller (see above) and others. The following is a *résumé* of the processes referred to: Lepidolith, pulverized and levigated, is made into a thin paste with sulphuric acid carrying a portion of nitric acid, and the mixture is kept in a warm place, with frequent agitations, until lumps have been formed. Heat is now applied until the free acid is driven off, and the residue is calcined. The mass, while still hot, is leached with boiling water, which leaves an undissolved residue of almost pure silica. The liquid thus obtained is treated with potassium sulphate which, combining with the alumina present, forms crystals of potash alum. The liquor drawn from the alum crystals is concentrated by evaporation during which process alum continues to be formed. Finally, lime is added to precipitate any possible residue of alumina, from which the liquid is filtered off. Barium chloride is now added to the filtrate, and the sulphates present converted into chlorides. The liquid is drawn or filtered off, evaporated to dryness, and the mass treated with dilute alcohol. From this solution the alcohol is recovered by distillation, and the watery residue treated with ammonium oxalate, which precipitates the lime, iron,

etc., still in the solution. The liquid filtered off from the precipitates, and containing all the alkalies in the form of chlorides, is further concentrated and the concentrate treated with ammonium carbonate. This throws down the lithium in the form of the carbonate salt (Li_2CO_3) which is washed with alcohol of 60 per cent. and thus freed of impurities. By this process lepidolith yields about 8 per cent. of lithium carbonate, equivalent to 1.51 per cent. of metallic lithium.

For a score of years after its discovery by Arfvedson, as mentioned in the beginning, lithium received but little attention. Berzelius gave it a bare mention in 1824, and it is merely alluded to by others, who found it in the waters of various springs in Bohemia and elsewhere. In 1841, Lipowitz published a paper in the *Annales de Chimie et de Pharmacie*, in which he reviewed the combinations of lithium with various acids, and dwelt particularly upon its marked affinity for uric acid, with which it forms an acid salt, "the most soluble of all the urates, being soluble in 60 parts of water at 122 degrees F., and not separating therefrom on cooling."[6] Dr. Alexander Ure, in 1843, refers to it as a remarkable solvent of sodium urate, but his use of the substance in practical therapeutics was rendered impossible by its scarcity and high price, and it was not until 1858 that it again attracted any attention in therapeutics. About that year Sir A. B. Garrod writes that he "commenced the administration of lithium salts as an internal remedy, both in cases of uric acid diathesis connected with gravel, and likewise in chronic gout, and was much gratified at the results." But he subsequently adds, "the great bar to the free use of lithium salts in medicine has been their expense."[7]

The price of the remedy, however, does not seem to have deterred Garrod from its continued use, since we find him, in the treatise referred to, devoting a very considerable space to a review of the important therapeutic results personally obtained by him from the use of the salts of lithium, and their undeniable

superiority over any other alkaline salts whatever, for both internal and external exhibition. An indorsement so unqualified, coming from such high authority, as a matter of course at once attracted the attention of the medical world to the remedy, and gave an immense impetus to experimental investigation with lithium salts in therapeutics. It is seldom, however, that the individuality of an investigator or observer is sufficiently pronounced to carry universal conviction of the truth of his observations or conclusions, especially in researches of this description; and here we find the medical profession at once divided as to the correctness and value of Garrod's conclusions. A controversy was inaugurated, on both sides of which talent and learning were enlisted, and which has brought about a very decided advance in the knowledge of the behavior of the alkalies in general, and especially towards uric acid. We need not dwell on the merits of this discussion, but pass to more modern matters.

The behavior of lithium carbonate toward uric acid, and its influence upon the solubility of the urates in the human economy, have in many instances without doubt, been greatly exaggerated, a fact due mainly to the lively imagination of owners of certain mineral springs, who herald their waters not merely in the daily press but in medical and trade journals through advertisements, in which to quote Dr. A. C. Peale:[8] "The fact that the water contains lithia, if only a trace, is made prominent by the incorporation of 'lithia' into the name or designation of the spring."

Louis Siebold rose against these unwarrantable exaggerations and usurpations in a paper on "Medical and Chemical Misconceptions about Lithia," read before the British Pharmaceutical Conference in 1889, the substance of which is that the lithium compounds "owe their place in the materia medica originally to the observation that, as compared with potash or soda, a smaller amount of lithia suffices to

form a soluble salt with uric acid, and that this salt is more readily soluble in water than the corresponding potassium and sodium salts. From a chemical point of view, its greater antacid or neutralizing power presents itself as owing to its low atomic weight." "It follows from the atomic weight of lithium and potassium that 74 parts of lithium carbonate possess the same acid saturating power and are likely to dissolve as much uric acid as 138 parts of potassium carbonate." This saturating power however, is confined only to the carbonate and indi-, rectly to the citrate, (which becomes converted into the carbonate within the organism); but "it is extended to a number of mineral waters containing lithia, generally mere traces of it, notwithstanding the fact that what there is of lithium in these waters generally occurs there as chloride or sulphate, salts which neither directly or indirectly act as alkalies and possess no solvent action on uric acid."

While such rational arguments are convincing to all reasoning men who, in fact, never entertained a different opinion to that expressed by Siebold, they are eminently dissatisfactory to those who prate of "God-given," "Heaven-endowed" fountains of health, "medicines wrought in the laboratory of Nature," and who are ready to apotheosize lithium and place it in the firmament alongside of Hygeia, or with the benign goddess of Greek mythology who hovered over mineral springs and endowed them with healing virtues. This idea seems still to be a favorite one with some mineral-spring proprietors, whose cards and advertisements display conspicuously the winged female with scanty drapery and small regard for the proprieties.

The occurrence of lithium in natural waters is necessarily limited, not merely on account of the limited amount in which it is found, but more especially on account of its existence *always in combination with the most insoluble constituents of the primordial rocks.* One need not, therefore, be surprised at find-

ing that the average content of the lithium salts in mineral springs is not more than 4 parts in 100,000 of water, or say 1 grain in 3¼ pints.

"Despite the long list of 'lithia springs,' whose advertisements we find in the medical and secular journals of the day, the actual number of those containing upward of four grains of lithium bicarbonate (equal to about two and five-tenths grains of the dry carbonate) to the gallon, is but fifteen,"[9] and this amount has been reduced by more recent analyses in which more accurate methods for the estimation of lithium were followed.

The physiologic investigations of the last decade into the nature of uric acid, and the importance of the rôle played by it in the human economy have maintained and even intensified the interest in the therapeutic value of the behavior of the salts of lithium towards this acid, first introduced by Garrod and sustained by his successors. The opposition to the views of Garrod, which sprung up years ago, culminated two years since in an elaborate work by Dr. Alexander Haig ("On Uric Acid," 1892), who undertook to prove experimentally on his own person that lithium administered for the elimination of uric acid from the system, not only failed to accomplish the purpose, but "diminished the excretion of uric acid." In defense of this position he quotes from Rose to the effect that lithium forms "insoluble compounds with phosphate of soda and triple phosphate of ammonia and soda, salts generally present in animal fluids." The work of Rose has not been accessible to me and I, therefore, am not in a position to assert whether or not Haig properly quoted or understood him, but I find that Dr. Halberstadt asserts that "sodium phosphate causes, in *not too attenuated* solutions of lithium salts, a crystalline precipitate of normal lithium phosphate;"[10] and Sir Dyce Duckworth[11] states that "the normal and bi-urate of lithium easily dissolve in alkaline fluids, also in phosphate of sodium."[11]

This is in accordance with my own experience, but I found also by actual experiment that no precipitation took place, even after several days, when such solutions are further diluted to 1 part in 250 or more parts of water before being mixed. When we take into consideration the minute amounts of sodium phosphate and lithium salts that can possibly meet in the blood-serum at any given moment, and that each meeting must occur in rapid motion, we must conclude that other causes have been instrumental in producing the results of Dr. Haig's experiments.

Another protest against the conclusions of Haig was recently published by a well-known French pharmacist, M. P. Ardoue, in *L'Union Pharmaceutique* (quoted in the *National Druggist*, Vol. xxi, p. 162), who records a case of gouty rheumatism, in which he had examined the urine of the patient before, during and after treatment, and determined a very decidedly favorable action of lithium salt in the excretion of uric acid.

The four experiments of Gorsky ought to be mentioned also, which he carried out in the year 1889 at the laboratory of Loersch at St. Petersburg on healthy men, each lasting twenty-four days, and by which he arrived at the conclusion that "carbonate of lithia administered in gradually ascending doses, from 2 to 8 grains a day with an effervescent water, increased the daily amount of urine and with it the daily amount of the excretion of uric acid;" and, he continues, "it is very probable that lithia favors the transformation of uric acid into urea, and hence by freeing the system from the acid, promotes a more energetic cellular action." It would therefore seem that the usefulness of lithium salts as a therapeutic agent had not yet outlived itself; but, on the contrary, that the salts will long continue to be employed as a great alleviator of human suffering.

[1] Just now while most physicians are better acquainted with the therapeutic properties of lithium than with its history as an element, I deem it proper to resurrect the true etymology of the word, as I find that many members of the profession connect its derivation with its solvent properties towards the stone-like concretions formed in the kidneys and bladder by uric (formerly called lithic) acid. This remarkable property, which earned for it the significant appellation of "lithontriptic," was not discovered until twenty-five years after the separation and naming of the element—a discovery, which while a mere coincidence would have been hailed with delight, had it occurred in other days, by the adherents of the "doctrine of signatures," who believed that every substance in nature, which possesses any medicinal property, indicates the same by some well-marked characteristic or appellation. Thus eye-bright (*euphrasia officinalis*) was deemed sovereign in diseases of the eye; saxifrage as a lithontriptic, etc.—(The author.)

[2] Dieulafait, Comptes Rendus, March 24, 1879.

[3] Bulletin 42, U. S. Geological Survey, 1883.

[4] H. Müller, Annales de Chimie et Pharmacie, Vol. cxx, p. 253.

[5] Archiv der Pharmacie, Vol. viii, p. 200.

[6] Ann. Chim. et Pharm., vol. xxxviii, p. 352.

[7] Treatise on Gout and Rheumatic Gout, by Sir A. B. Garrod, first edition, 1860, third edition 1877, pages 368-369.

[8] Dr. A. C. Peale, Classification of Mineral Waters, May, 1887.

[9] Dr. Frank L. James, Lithium in Mineral Waters, St. Louis Med. and Surg. Journal, vol. lvii, p. 24, July, 1889.

[10] Nemnes Handwoerterbuch der Chemie, vol. iv, p. 137.

[11] Treatise on Gout, 1859, p. 33.

The Lithia Waters of Dr. Enno Sander.

It appears from the foregoing essay that lithium carbonate is the most efficient neutralizer of all the lithium salts, and therefore best adapted for the treatment of the diseases of the uric acid diathesis, and it remains only to be ascertained in what form it should be administered, in order to obtain the most favorable results. Manufacturers have greatly taxed their ingenuity and have produced very elaborate, concise and palatable solid forms of the remedy, and the more elegant their appearance the greater the impression made on the profession. But will it act as effectively and promptly in solid form as it does when in solution? And is it not almost an axiom in therapeutics, that the activity of remedial substances is greatly enhanced by their administration in the shape of carbonated waters? Among other authorities Dr. J. Rosenthal, Professor at the University of Koenigsberg, in his article on the "Administration of Kreosot in Tuberculosis," referring to the administration of kreosot in carbonated water says: "Here we find again confirmed the *well-known axiom* on the application of mineral waters in therapeutics, that a remedy prepared and administered in the form of a carbonated mineral water produces an effect three to four times stronger than when given in the form of pills or otherwise." (Berliner Wochenschrift, vol. xxv p. 668).

More than fifteen years ago I applied this principle to lithium carbonate and constructed a formula for a carbonated lithia water, which has received during these many years the hearty approval and the most generous support from the medical profession.

The "Treatise on Gout and Rheumatic Gout," by Sir A. B. Garrod, constituted in those days the principal source of information concerning the diseases treated in it and of the therapeutical action of the lithium salts. Being greatly benefited by the study of the work, I concluded to call the new mineral water "Garrod Spa." I did not like, however, to use the illustrious name without the permission of its owner, and requested a friend to deliver a letter in which I asked the coveted favor, and get an answer, if possible, in writing. Sir Garrod did not want to violate the professional ethics and write himself out of the profession, as he called it, unlike others who have freely given their written praises of so-called natural mineral waters, to be published in the public press, but he told my friend that inasmuch as my formula represented his own ideas, he had no objection to the use of his name, especially as it would simply designate the source from which the formula had been obtained.

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1. THE SPARKLING GARROD SPA, A LITHIA-POTASH WATER.

Put up in Pint Bottles.

Lithium bicarbonate	14 grs.
Magnesium bicarbonate	10 "
Potassium bicarbonate	16 "
Sodium chloride	10 "
Carbonated water	16 oz.

"When carbonate of lithia is given internally in doses from one to five grains dissolved in aërated water, and repeated two or three times a day, it produces no direct physiological symptom, but when patients are voiding uric acid gravel, it exerts a marked influence, causing the deposits either to become less or to cease altogether." (Treatise on Gout and Rheumatic Gout, 1876, p. 367.) Hereby the daily maximum dose is placed at from 10 to 15 grains, which is not only maintained, but even increased by other authors, for Sir Dyce Duckworth recommended

"lithia water containing five grains of the carbonate salt in ten ounces of aërated water to the extent of three or four bottles each day in any case of gout as an ordinary drink." (A Treatise on Gout, 1889, p. 381.) Sir Garrod again mentions that "the use of lithia salts continued for seven years not only prevented the formation of calculi, but likewise the recurrence of any gouty attack." (Treatise on Gout and Rheumatic Gout, p. 470.) And still further adds "that although many of my patients have continued the use of lithia salts for a long time, I have never been able to detect any really injurious effects," and then quotes Dr. Charcot from the French edition of his work: "That he has given carbonate of lithia to the extent of thirty and forty grains in the twenty-four hours without the production of any unpleasant symptoms." (Treatise on Gout and Rheumatic Gout, p. 372.)

If we now convert the carbonate salt, according to the recent fashion of calculating the solid contents of mineral waters, as is shown in the above formula, into bicarbonates, we find an apparent great increase in the doses just mentioned. The chemical equivalent of lithium bicarbonate is almost twice as large as that of the carbonate, or 1 part of the latter is equal to 1.8375 parts of the former, which means that a dose of 15 grains of the carbonate is equivalent to 27.56, and one of 20 grains to 36.75 grains of the bicarbonate salt. The formula of the Garrod Spa exhibits 14 grains of lithium bicarbonate, which in fact is a trifle short of the truth, for in manufacturing the water 8 grains of the dry carbonate are used to each pint of water, which is equivalent to 14.7 grains of the bicarbonate. The contents of the bottles are 12 ounces, therefore each contains 6 (or respectively 11) grains of the salt, which must be considered an adequate dose according to the opinion of a great many physicians who have employed the water. The potassium bicarbonate has been added to the formula, because its combination with the

lithium salt has been known as producing a very energetic and beneficial effect upon the human system, and the small quantity of magnesia has caused a slight but felicitous effect upon the liver and the intestines. The sodium chloride acts as a corrective of the alkalies to the taste.

Dr. H. C. Klueber of California, Mo., has used for himself and his patients one bottle of the Garrod Spa every other day and completely relieved his own gout and all the cases which came under his treatment. Other correspondents have employed larger doses, even three and five bottles a day, and severe acute attacks of gout have been relieved in two days by the administration of four bottles a day without the observation of the slightest disturbance of the digestive apparatus. Dr. Eustathius Chancellor, an eminent physician of St. Louis and Secretary of the Association of Military Surgeons of the United States who was suffering greatly with lithæmia, bordering on rheumatic gout, took five bottles within two days of the Garrod Spa for many a week, until he had completely conquered the formation of uric acid, which at first was so prominent in his urine, that it freely deposited its peculiar crystals on the sides of the bottles in which he tested it. He was also delighted with its pleasant laxative effect upon his bowels. He has recovered from his sickness, but he still continues to take a bottle from time to time.

Dr. Charles Dake of Hot Springs, Ark., whose prescriptions have been sent to me from almost all parts of the country, has assured me without solicitation that of all the preparations of lithium carbonate, which he had employed in his extensive practice, none had acted so beneficially and promptly as the Garrod Spa. He therefore considered it the most reliable of the lithium preparations in the treatment of gout, rheumatism and kindred diseases. I have been the recipient for years of the most flattering letters and exquisite testimonials to the efficiency of the "Garrod Spa," but I refrain from publishing

them, because it appears to me that the abnormal quantities of certificates, which are given to almost any kind of preparations and published by their owners, has destroyed all confidence in them. I prefer instead, as I have done before, to publish the names of the physicians who have used my mineral waters and who are still using them, but I ask permission to add here a few extracts from medical journals expressing the opinion of their editors in regard to Garrod Spa:

"*For summer diarrhœa, where there are acid and strongly offensive evacuations*, the use of lithiated waters must strongly commend themselves to the practitioner; in fact, the therapeutic uses of lithia seem to be widely extending. It will also be found of value in sick headache, and in all cases where antacids are indicated.

"*The secret of the remedial virtue of lithia is in its solvent powers as an antacid, and its formation of a soluble salt when in combination with uric acid.* This must lead to its ever increasing use and popularity."—Dr. J. C. Culbertson, *Cincinnati Lancet-Clinic*, June 28, 1890. p. 789.

"During the heated term when the intestinal canal is prone to riotous conduct—in other words when gastro-intestinal troubles abound, dependent in a majority of cases upon an acid fermentative condition of the bowels, the habitual use of the effervescent lithia-potash water, or "Garrod Spa," of Dr. Enno Sander, will be found to serve admirably as a curative and prophylactic measure.

"In infants and children it is a splendid substitute for lime-water, being more agreeable when used as a drink, or added to milk.

"It is not only a pronounced alkali, but being carbonated it enlivens all fluids to which it may be *added*."—Dr. I. N. Love in the *Medical Mirror*, July, 1890, p. 334.

It should not be forgotten to mention that the Garrod Spa combines with its efficacy an agreeable, palatable taste, and that by the addition of a tablespoonful of lemon juice to a tumblerful of the Spa, a pleasant, sparkling, *aperient* draught is obtained, while the alkalies will still exercise their peculiar and proper functions upon the uric acid. For the information of the physician, the formula of the solid contents of the water is printed on the label of each bottle.

2. THE STILL GARROD SPA.

Put up in Half Gallon Bottles.

Cases frequently occur where, from idiosyncrasy of the individual, or from some peculiar irritability of the stomach, the use of carbonated water is contra-indicated. This has suggested the preparation of a still water, containing less of the lithium salts, which may be used for flushing and cleansing the system. I have therefore been induced to reduce the amount of lithia in my "Still Garrod Spa" from one-half to one-fourth of the strength of the "sparkling" water. One half gallon bottle of the former now represents the medicinal ingredients of one pint of the latter.

In the manufacture of this, as in all my mineral waters, I am using aërated, distilled water (described in an interesting little circular entitled: "A new Process for obtaining Pure Water," copies of which may be had on application), absolutely pure and entirely free from all organic or inorganic substances, as has been testified to by the well-known chemist and microscopist, Frank L. James, Ph.D., M.D.

The STILL GARROD SPA requires a number of manipulations permitting the access of atmospheric air, which by their peculiar process of manufacture is entirely excluded from the carbonated waters. In order to guard against the occurrence (too frequently seen in bottled natural waters) of algæ, infusoria and microörganisms, all of which are air-sown, all the bottles of the Still Garrod Spa are sterilized after being corked. After being carefully closed with selected corks, each of which is itself sterilized by steaming, the bottles are transferred to a specially constructed tank, where they are maintained for one hour at a temperature far beyond that at which any living organism can exist. Thus I obtain a pure, durable water that will stand the test of any climate and age.

3. THE AMERICAN LITHIA WATER.

The most Delightful and Palatable of all Table Waters.

Put up in Pint and Quart Bottles.

It is, without question, most gratifying to a manufacturer of waters to find his preparations appreciated by those for whose benefit they were elaborated, but it is still more gratifying to have, as has been my good fortune, further demands made upon his ingenuity. After the superior quality of my Garrod Spa had been recognized by the medical profession, I was requested by numbers, and among them the most prominent physicians of Chicago, to construct a formula for a mild, agreeable, carbonated lithia water for general use, at the table and otherwise, which without being medicinal would contain just enough of the alkaline salts to render its action prophylactic and thus prevent the accumulation of uric acid in the system. The social obligations of a gentleman also too frequently require of him a greater indulgence than he can constitutionally tolerate, and the natural lithia waters contain such an insufficient amount of the alkali that their use has little or no more effect than so much plain water. The *American Lithia Water*, the name that I have given the new compound, at once received the approbation of those who suggested its manufacture. It is not only of an exceedingly agreeable, soft taste and mixes well with wines and liquors, but, on account of its definite and proportionate content of lithium bicarbonate, it permits a more liberal use of stimulants. "It is evident that its use is of the greatest advantage to persons who are in the habit of using wines and liquors, and where other waters act as diluents simply, it has not only shown decided influence in preventing the effects of over-indulgence, but it has been prescribed by physicians for the purpose of restoring persons to their normal condition." It has become very popular, and the prediction of Dr. J. C. Culbertson, of

Cincinnati, in his *Lancet-Clinic*, has been realized, that "it should be the favorite club-house, fashionable bar and hotel drinking-water." "Dr. Prendergast, Health Commissioner of the city of Cincinnati, says that for prompt clearing out of the intellectual field in the person of one who has too liberally imbibed, nothing equals liberal potations of the American Lithia Water. He advises the administration, slowly and gradually, of several bottles, a glassful taken at intervals of ten minutes, until the amount is consumed. The rapidity with which the alcohol is eliminated through the kidneys, and the upper territories of the anatomy are cleared of smoke, is surprising."—(Dr. I. N. Love in *Medical Mirror*, June, 1894.)

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4. THE ARSENIATED LITHIUM WATER.

Put Up in Pints.

Dr. Martineau's report on his successful treatment of Gouty Diabetes by lithium and arsenic, excited the attention of prominent physicians, and in order to meet their wishes I compounded the Arseniated Lithium Water, following strictly the advice which was given at the time by the *European Medical Journal*. In the place of any further description I prefer to re-publish the article which appeared in the *New England Medical Monthly*, July, 1891:

"This rather complicated condition is one which requires great care in its therapeusis, and its treatment is frequently of a prolonged character. Many methods have been proposed with more or less success attendant upon their application. One of the best which has been devised is that of Dr. Martineau, of Paris, who has definitely cured 67 out of 70 cases, in the past twelve years. Dr. Dujardin-Beaumetz has also recommended and even adopted this treatment, in which they have employed carbonate of lithium and arsenic in such a manner as it is com-

bined and manufactured by Dr. Enno Sander, whose formula is as follows:

"R—Lithium bicarbonate . . . . . gr. 5.514
Sodium arseniate . . . . . gr. 0.100
Carbonic water . . . . . ℥ 16.00
℞

"This quantity, which is the contents of one bottle, should be taken, mixed with claret wine, at three successive meals. The diet need not be restricted, with the exception of starch, sugar and fruit. The latter articles should be prohibited, but in so far as the rest of the diet for diabetes is concerned, considerable freedom may be permitted. In taking the water, care must be exercised to drink it either during or immediately after eating, although it is a better and preferable method to take it during the course of the meal. The addition of the carbonic water renders the remedial agents less irritating to the stomach and more digestible; it also adds to the palatable qualities of the water."

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5. THE BENZOATED LITHIUM WATER.

Put up in Pints.

Although Neubauer and Vogel in their treatise on "The Urine and Urinary Deposits" (§ 108) state that the "formation of an excessive quantity of uric acid can be combated by the use of benzoic acid, because under the influence of the latter, hippuric acid is formed instead of uric (Ure., Keller), has been recognized as erroneous, and consequently the employment of benzoic acid in combating the uric acid diathesis has no practical value," a French pharmacist of the first class, M. P. Adoue of Pauillac entered a protest in *l'Union Pharmaceutique*, October, 1892, page 443, against their opinion and declared himself in favor of lithium benzoate: "M. X., who was suffering with gouty rheumatism, and had not yet tried the salts of lithium, asked me to make an analysis of his urine. I did so and found 22 gm., 50 cgm. of

urea, and 73 cgm. of uric acid to the liter. Microscopic examination revealed no hippuric acid crystals whatever. A few days later, under the advice of physicians, he commenced the use of lithium benzoate in pills, and in effervescing waters. A month later I examined his urine again, and found hippuric acid in considerable quantity; in fact, in great masses, resembling the ammonia-magnesian phosphate. The analysis showed the presence of 13 gm., 80 cgm. of urea, 95 mgm. uric acid, and 21 cgm. hippuric acid to the liter. The patient was much improved in every way, and continued the use of the remedy, with excellent results. I desire, therefore, to put myself on record with Ure and Keller as to the value of lithium benzoate in the treatment of rheumatism and gout, and as opposed to the notions of Neubauer and Vogel."—(From the *National Druggist.*)

Dr. Robert Luedeking, Professor at the St. Louis Medical College, an eminent and successful practitioner of St. Louis, after having successfully employed lithium carbonate and benzoic acid in cases of uric acid diathesis, wished to use the same in the form of a carbonated water and requested me to make calculations for a suitable formula and with his consent I prepared the Benzoated Lithium Water after the following formula:

Lithium benzoate	12.823 grs
Lithium bicarbonate	13.784 "
Potassium bicarbonate	10.000 "
Sodium chloride	10.000 "
Carbonated water	16 ounces.

The water has been used with great success by Dr. Luedeking and other practitioners, of whom Dr. George F. Hulbert has expressed his opinion in a paper "A Contribution for Definite and Known Quantity and Quality in Mineral Waters," read at the meeting of the Mississippi Valley Medical Association at St. Louis, Oct. 1891, and published in the

JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, Dec. 5, 1891:

"Hence we find the Lithia-Potash water best adapted for the rheumatic, and the Benzoated Lithium water for gout, rheumatic gout, renal and vesical concretions. It has been our practice to use the latter in all acute severe rheumatic conditions, until they were controlled, then change for the steady, long-continued use to the former, the 'Garrod Spa' water. In gout, rheumatic gout, gravel and vesical concretions the benzoated has been of most value until the morbid process was well nigh completely overcome.

"The usual dose is one-third pint three times a day between meals and at bed-time; in severe cases increased to one-half pint at same time of day until symptoms are under control; then the former dose."

After citing several cases successfully treated with this lithium water, he quotes one which occurred in the St. Louis City Hospital under the care of Dr. H. C. Dalton, who rendered the following report:

OFFICE OF CITY HOSPITAL.
H. C. DALTON, M.D., Supt. and Surgeon in Charge.
ST. LOUIS, MO., Oct. 10, 1891.

DR. G. F. HULBERT, 3026 Pine Street.

Dear Doctor:—Your card of yesterday received. Chrissy S. was admitted to this institution May 22, 1891, suffering from a very acute attack of articular rheumatism. She was in her fifth month of pregnancy.

The rheumatism developed three days prior to her admission to the hospital. I saw her shortly after admission, and found the following condition: Left knee greatly swollen; complained of great pains in right hand and arm, both of which were swollen. A few days after admission, her left wrist and right ankle became greatly swollen and acutely painful.

She was given large doses of salicylate of soda, which gave her but little, if any, relief. The changes were rung upon the various remedies for acute rheumatism without avail. After July 6 she was given a bottle daily of Benzoated Lithium Water (Sander's). In a few days marked improvement was observed. On August 12 patient was free from pain and able to sit up, the swelling having entirely

disappeared from her joints. In fact, she expressed herself as feeling entirely well, though still quite weak.

She has not had the slightest symptom of the disease since. On the 3d ult. she was confined, and has done well since. After taking the Benzoated Lithium water for ten days, the amount administered was increased to a bottle and a half daily. Very truly yours,

H. C. DALTON, M.D.

The water is palatable and pleasant to take, and unites all the advantages that may be had from benzoic acid, lithium and potassium.

Herewith I may leave my lithia waters conscientiously and trustfully to the care of the medical profession with but one request, which is, that when prescribing any of them, to mention my name in connection with the water.

On the last page of this pamphlet you will find the names of such firms and places where the waters may be obtained at wholesale and retail outside of St. Louis; here it can be purchased either direct from the factory or from any of the wholesale and retail drug houses.

THE GARROD SPA AND THE OTHER LITHIA WATERS

OF THE

ENNO SANDER MINERAL WATER CO.

ARE DISTRIBUTED BY THE FOLLOWING FIRMS:

R. E. Rhode, 504 N. Clark St., Chicago.

John Blocki Drug Co., 108–110 Randolph St., Chicago.

Grommes & Ullrich, 104–106 Madison St., Chicago.

John D. Park & Sons Co., 175–179 Sycamore St., Cincinnati.

The Joseph R. Peebles' Sons Co., Pike Building, Cincinnati.

Eisele & Hunt., 184 Central Ave., Hot Springs, Ark.

Weimar, Klein & Co., Avenue Hotel, Hot Springs, Ark.

Evans-Gallagher Drug Co., 424–428 W. Fifth St., Kansas City, Mo.

Fahlen & Kleinschmidt, Main & Beal Sts., Memphis, Tenn.

H. O. Frank, E. Water & Wisconsin Sts., Milwaukee, Wis.

Spiegel & Co., 101 Grand Ave., Milwaukee, Wis.

R. H. Lane, 501 Hennepin Ave., Minneapolis.

J. O. Burge, Union & Cherry Sts., Nashville, Tenn.

J. N. Hegeman & Co., 770 Broadway, New York City.

Richardson Drug Co., 9th & Jackson Sts., Omaha, Neb.

Sherman & McDonnell, 1513 Dodge St., Omaha, Neb.

H. C. Swartley, 1410 Chestnut St., Philadelphia.

Shinn & Baer, Broad & Spruce Sts., Philadelphia.

Laue-Davis Drug Co., 175 Third St. Portland, Ore.

W. M. Searby, 400 Sutter St., San Francisco.

Fr. McMullen, 322 Bush St., San Francisco.

Ryan Drug Co., 225–229 E. Third St., St. Paul.

Lippman Bros., Congress & Barnard Sts., Savannah.

C. C. Bryan, 1413 New York Ave., Washington, D. C.

W. S. Thompson, 703 Fifteenth St.. Washington, D. C.

MINERAL WATERS & GINGER ALE
125-129 S. 11th St. St. Louis.