percentage of NO_3 found by oxidizing ferrous chloride, we obtain the following results: The average of the first and second determinations of sugar by reducing with ammonic sulphhydrate (28.4 and 28.7) gives 28.55 per cent. of cane sugar in nitrosaccharose. The average of two determinations of NO_3 in nitrosaccharose (41.6 and 41.3) gives 41.45 per cent. of NO_3 in that body. Adding these together we have 70.00 per cent. as a total; the balance of the percentage consists of water, some free acids, and probably other compounds resulting from the action of the acids upon the sugar. Calculating the determined constituents to per cent., we have cane sugar, 40.78, to NO_3 59.21, or a ratio of 1 molecule of cane sugar to 8 molecules of NO_3 (exactly 1 to 8 009) From these figures it would appear that nitrosaccharose is formed by replacing eight atoms of hydrogen in a molecule of sugar by eight molecules of NO_3, giving the formula $C_{12}\, H_{14}\, (NO_3)^8\, O_{11}$. Assuming that this is the correct formula for nitrosaccharose, the theoretical percentage yield of its constituents would be sugar 41.20, NO_3 59.75. When we compare these figures with those actually obtained above, and remember that the methods used are not capable of great exactness in results, it appears most probable that the above is the true formula for nitrosaccharose.

XXXII.—NOTES ON BONE OIL.

By Arthur H. Elliott, Ph. B., F. C. S., and Ferdinand Sands, A. B., Ph. B.

During the Spring of 1881, Messrs. C. P. Sawyer and W. W. Share, two students of the class of 1881, of the School of Mines, at the suggestion of Prof. C. F. Chandler, undertook to investigate bone oil, and repeat some of the work of Anderson,[*] C. G. Williams,[†] Vohl,[‡] Church, and Owen[§], Schwanert,[‖] Unverdorben[¶] and Runge.[**]

---

[*] *Phil. Mag.*, (3) vol. xxxiii. p. 174; (4) vol. ii. p. 457 ; (4) vol. ix pp. 145 and 214. *Trans. Roy. Soc Edin.*, vol. xvi. p. 4; vol. xx. (2) p. 247; vol. xxi. (1) p. 219 ; vol. xxi. (4) p. 571.

[†] *Chem Soc. Jour.*, (Lon.), vol. vii. p. 97. *Proc. Roy. Soc.*, vol. xiii. p. 305; vol. xii. p. 311.

[‡] *Jahresb.*, 1859, p. 742.

[§] *Jahresb.*, 1850, p. 359. *Phil. Mag.*, (4) vol xx. p. 110.

[‖] *Am. Ch. Pharm.*, vol. cxx. p. 279.

[¶] *Pogg. Ann.*, vol. xi. pp. 59, 67; vol. viii. pp. 259, 480.

[**] *Pogg. Ann.*, vol. xxxi. pp. 65, 67. *Chem. Gaz.*, 1855. p. 308.

For this purpose they took five barrels of bone oil and submitted it to distillation, a process whose disagreeable nature none can appreciate but those who have had the task. These hard working gentlemen succeeded in obtaining a number of interesting results from the various distillates, and it is to be hoped that some day they will publish an account of them. From the five barrels of bone oil they obtained (after losing about one and a half barrels by foaming) about ten gallons of light oil and water. On treating this light oil with sulphuric acid they obtained a reddish gelatinous mass which they placed on one side, and continued their work upon other products of the bone oil.

During last winter we thought it would be interesting to find out the character of the red gelatinous body, mentioned above, obtained by treating the light oil from bone oil with sulphuric acid. We therefore took some of the distillate obtained by Messrs. Sawyer and Share and treated it with sulphuric acid. Two litres of this distillate, were mixed with about twice the volume of water, 500 c. c. of concentrated sulphuric acid were added with constant stirring, and the whole allowed to stand twenty-four hours. At the end of this time a heavy granular reddish-yellow precipitate had separated, which was strained out through muslin and squeezed in a screw press to remove acid and oil. It was thoroughly washed with water, soaking many hours, between each new addition of wash water, and it gradually assumed a darker color, finally becoming a dark brownish-black. The liquid strained from the precipitate obtained above, and containing oil, was again treated with 500 c.c. more of concentrated sulphuric acid, well agitated, and allowed to stand twenty-four hours. Another quantity of the reddish yellow precipitate was found and separated as before; it also turned brownish-black after a time. The strainings from the second precipitate were treated with sulphuric acid, and more precipitate was obtained. A fourth treatment of the strainings gave but a little of the precipitate and the treatment was discontinued. During this treatment the oil became smaller in quantity and at last there was practically nothing left from these operations but the various precipitates and the strongly acid fluid with a little oil floating on the surface.

The original light oil had a specific gravity of 0.8354 at about 20°C. and boiled at about 120°C.,at which temperature it is distilled very rapidly. This oil does not mix with water and is soluble in alcohol.

The brownish-black precipitates obtained above were all washed with ether, alcohol, and finally with hot water, and dried in a water bath. As various quantities of acid were added to the successive strainings, the precipitate became more densely gelatinous and of the consistence of leather that has been burned. But by treating with ether, alcohol, and hot water, it was found that all the precipitates could be reduced to the same black powder. This black powder was heated with the following solvents without effect: Alcohol, methyl alcohol, turpentine, glacial acetic acid, sulphuric acid, petroleum-naphtha, phenol, and glycerine, ether, chloroform, amyl alcohol, nitrobenzol, acetic ether, acetone, toluol, and carbon disulphide. If fuming nitric acid is dropped upon it violent deflagration takes place; but by pouring an excess of this acid upon the black powder, no action takes place immediately; only after long standing complete solution takes place. This solution, when diluted and excess of ammonic hydrate added, gives a bright scarlet solution, but no precipitate.

We tried the action of these solvents in the hope of being able to crystallize this body, and finally we gave up the idea. We therefore treated it again with ether, alcohol and hot water, which gave us colored solutions in each case. On evaporating these solutions we find that only trifling quantities of oily matters were left; which, in the case of the ether solution, itself of a dark orange color, gave a slight green fluorescence before evaporation.

After careful purification as above stated, an analysis of the powder was made. Much trouble was encountered in determining the carbon and hydrogen, owing to the fact that the body was found to contain considerable sulphur. But we finally succeeded in getting duplicate analyses that were satisfactory. For this purpose we mixed the black powder with a large quantity of fused lead chromate in fine powder; the gases were then made to pass over granulated copper oxide and about four inches of clean copper gauze recently reduced in hydrogen.

The nitrogen was determined by heating with soda-lime, and gave very satisfactory results.

In the case of the sulphur we had another set of failures; the fine condition of the powder causing most violent action, with various oxidizing agents. We finally succeeded in getting fair results by fusing with a mixture of twelve parts of mixed carbonates (7 of potassic carbonate to 5 of sodic carbonate), and three parts of potassic nitrate, to one part of the powder. By this means, using a moderate heat, we succeeded, in getting a quiet fusion with very gentle deflagration. Care must be taken that the fusion mixture is dry and finely powdered, and that the black powder is very intimately mixed before heating for fusion.

We made many determinations of the various constituents of this curious body, many of them approaching the results given below, which are those obtained after considerable experimenting on the various methods used for its analysis.

The following is the percentage composition of the brownish-black powder resulting from the change of the orange-red precipitate obtained by heating the bone-oil distillate with sulphuric acid:

	I	II.
Carbon	59.56	59.44
Hydrogen	6.28	6.22
Nitrogen	11.90	11.90
Sulphur	3.92	4.15

Anderson and Schwanert both analyzed this body, but no mention is made of the presence of sulphur in it. Anderson's figures are 71.98 carbon, 6.88 hydrogen, 13.59 nitrogen; while Schwanert, who made the body from carbopyrrolic acid, found smaller quantities of carbon and nitrogen. We make these statements since we believe this body is what is generally known as "pyrrol red," and formally examined by Anderson and Schwanert with the above results. Wiedel and Ciamician* have recently worked upon this body, and have not been able to obtain it of constant composition, since they examined it in the red condition, when it changes very rapidly. The last authors do not mention the presence of sulphur in this body, and we have searched in vain for such a record. We are led to believe that pyrrol red is a compound of sulphuric acid (or hydrochloric acid when produced by that agent), with the light oil obtained from bone-oil, but cannot at present give the constitution of the body, as our work is incomplete. We would mention that by boiling with strong solution of potassic hydrate no action takes place and no perceptible quantity of ammonia is evolved; but by fusing with solid potassic hydrate after evaporation of the mixture of the black body with solution of potassic hydrate, we have obtained an oily distillate that appears very much like the original oil of the bone-oil distillate which we started with. At present we have not obtained enough of this material to examine its character.

---

*Berichte xiii., 65–85.

We have given these notes to call attention to our work and to see if others have not perhaps already arrived at similar conclusions. We are well aware that many others have labored hard in this field, but we have done our work with every endeavor to arrive at facts, and hope to be able to continue the investigation the coming winter, when we shall prepare this body in other ways and analyze the oil obtained by fusing with potassic hydrate.

XXXIII.—ON THE COMPOSITION OF ELEPHANT'S MILK.

By Charles A. Doremus, M. D., Ph.D.

In the spring of 1881 an opportunity presented itself for obtaining several specimens of milk from the elephant Hebe. The analysis of these samples were reported in Vol. III of the journal of the society. The exceptional character of the milk made it desirable to obtain further specimens. At the time the first investigation was undertaken two other female elephants were supposed to be with young. Such proved to be the case with one only.

The elephant Queen gave birth to a female calf at Bridgeport, Connecticut, on February 22, 1882, and the new baby was named after its birthplace. My intention was to collect some of the first milk secreted, but, though unsuccessful in this, I procured a quantity about thirty-six hours after the birth of the calf. This milk still possessed the qualities of colostrum.

The colostrum collected presented the appearance of thin milk. On standing it separated into three layers—the cream uppermost, then the usual blue layer, and at the bottom a yellow stratum composed mostly of mucous cells held together in a glairy fluid. These cells were uniform in size and in comparison with the oil globules not of that relative size usual in colustrum corpuscles. Of those peculiar bodies there were indeed few, unless these smaller cells represented them. The fat globules were not uniform in size, nor did they present that peculiar aggregation noticed in the milk from the elephant Hebe, or later that of Queen.

As the presence of albumen is one of the characteristics of colostrum, an attempt was made to determine its quantity, as well as the quantity of casein. The task proved difficult. At first Hoppe-Seyler's method was adopted, viz., that of acidulating the milk, greatly diluted, nearly to the point of coagulating the casein and then completing the reaction by saturating the liquid with CO_2. A flocculent