If the rotation period is long then it seems necessary to assume that the surface of Venus is still highly heated and emits its own proper radiation.

If the rotation period is short then, owing to the relatively dense atmosphere, the heat would be retained for some hours after sunset, as obtains on this earth, which is less highly heated owing to its greater distance from the sun.

The fact that the southern hemisphere (the bright cusp as well as the adjoining dark region) is hotter than the northern (cusp and contiguous dark area) might be owing to a difference in surface conditions as observed on Mars. This difference in temperature may be owing to a tilting of the axis of rotation, a variation in insolation, and a consequent change in the seasons, as observed on the earth and on Mars. If this is the case then, in the course of time, temperature conditions should be reversed and the northern hemisphere should become the hotter. This, as well as several other questions, can not be answered without further observations extending over a long period.

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A NOTE ON THE RING METHOD OF MEASURING SURFACE TENSION

WHEN one consults tables of physical constants for the values of the surface tension of water in contact with air at a given temperature, one is struck by the variety of values given, depending upon the method used. The ring method has been criticized because the values given (Weinberg, duNoüy) although consistent among themselves, differ considerably from the values obtained by other methods. The average of values by the ring method at 15° is 76.6 dynes per centimeter, whereas a probable average of values by other methods at the same temperature is 73.4 dynes per centimeter. The difference of 3.2 dynes remains to be explained.

Fahrenwald[1] attempts an explanation of the high values obtained by the ring and similar methods, in stating that in addition to the true surface tension there is a force due to a column of liquid beneath the edge (ring) to which the liquid adheres; and that this column is supported, not by the surface tension, but by attraction between the edge (ring) and the liquid molecules. Although the explanation is correct for the equilibrium condition when the upward pull on the ring is much below that attained at the instant of rupture, it does not apply in the latter instance.

In our analysis of methods used in measuring surface tension we may logically assume that in any simple liquid, such as water, surface tension is a definite physical property which, under fixed conditions, should be quantitatively expressible with a degree of accuracy limited only by the experimental conditions. The outstanding difference of 3.2 dynes is a strong indication that a source of constant error, either in the ring method or in the other methods, must have been overlooked by the experimenters. Recently, in making measurements with the apparatus of duNoüy, the writer had occasion to determine if possible whether the difference might be attributable to the ring method or merely to the technique by which the measurements are made. That Fahrenwald's explanation is probably incorrect is shown by the fact that as the ring is pulled up out of the surface by the application of increasing force, there is a point at which the liquid adhering to the ring is suddenly drawn out into a thin annular film, several millimeters long, yet retaining stability. As the force is gradually increased the point is finally reached at which the film breaks. This film is so thin at the instant of rupture that an error of 3 dynes certainly can not be attributed to it. It is found further that after the ring has been pulled away, droplets adhere to it. DuNoüy has found (private communication) that the weight of these droplets for a given size of wire in the ring is very constant indeed, their weight amounting to about .24 dyne per centimeter length of wire for the size used in the duNoüy tensiometer. This value increases with increasing thickness of wire. Obviously the amount of liquid pulled away with the ring does not account for the difference of three dynes.

The following explanation is believed to be the correct one. As the ring is drawn out of the liquid the upward force on the ring, measured by the torsion of the wire, is just balanced by the weight of liquid elevated above the normal surface. It is important to note that the scale readings of the instrument are taken with reference to the scale zero, and that the scale zero corresponds with the actual zero of torsion only when the arm which carries the ring is in its position of zero-balance. As the ring is pulled higher with increasing force, the true zero on the scale, with reference to which readings should be taken, shifts upward from the scale zero by an amount which corresponds to the position of the arm. Consequently, at the instant the film ruptures, the scale reading will be too high.

A new technique has been devised whereby the vessel containing the liquid is gradually lowered, by means of the screw adjustment on the support, while the increasing force is being applied, all the while maintaining the arm in its position of zero-balance. Thus the scale zero remains the true zero, and therefore readings of the scale will correctly represent the force at the instant of rupture. The error due to the droplets adhering to the ring is easily corrected by

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[1] J. O. S. A. and R. S. I., 6, 722, 1922.

considering them as part of the ring and adjusting the zero balance of the instrument with the droplets adhering to the ring.

Experiments to test this explanation have shown a difference of 3.3 dynes per centimeter for water when the former technique and the new technique, respectively, were employed. This brings the results by the ring method into agreement within .1 dyne with the average of the values obtained by the other methods. The modified technique therefore bridges the gap between the ring method and the group of other methods cited in the literature, and it finally removes whatever doubt there might have been about the trustworthiness of the ring method.

A more detailed description of the new technique, together with experimental data, will be published elsewhere.

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HEAT OF WETTING AS A NEW MEANS OF ESTIMATING THE COLLOIDAL MATERIAL IN SOILS

ONE of the greatest needs in soil studies is a method for determining the amount of colloidal material in soils, for it now appears that most of the chemical and physical reactivities and properties of soils are due mainly to their colloids. Such phenomena as adsorption and absorption of chemical reagents, moisture adsorption and retentiveness, heat of wetting, unfree water, rate of evaporation of water, plasticity, cohesiveness, etc., are all closely associated with or mainly controlled by the colloids in the soil. To intelligently understand and compare the different soils with one another it is important and essential, therefore, to know their colloidal content.

At present there is really no method for determining quantitatively and accurately the colloidal material of soils. There have been several methods proposed, but it appears that all of them involve serious errors. Probably the most important methods proposed are those based upon the adsorption of dyes and those upon the adsorption of liquid vapors. The methods in the first category involve the serious error that the different soils contain different kinds of colloids which adsorb the same dye differently and consequently the results are reliable neither quantitatively nor relatively. The methods in the second category contain several disadvantages which may be accompanied with serious errors. Some of these disadvantages are as follows: (1) Besides the real surface adsorption there may also be a capillary absorption, *i.e.*, a condensation of vapor in the capillaries; (2) there may be a condensation of vapor by a slight change of temperature; (3) the procedure is long and uncertain as to when equilibrium is attained.

The present writer has been interested in trying to work out a method for determining the colloidal material in soils for some little time. After trying out several methods, including those mentioned above, he has come to the conclusion that the heat of wettings presents probably the best means for estimating the colloidal content of soils, as well as their state of activation. It has been found that the heat of wetting of soils is due mainly, if not entirely, to their colloids, as non-colloidal material even in very fine state of division does not produce heat of wetting. For instance, rocks and minerals ground to very fine condition fail to give any measurable amount of heat of wetting. Even colloidal soils which give a tremendous amount of heat of wetting in their natural state fail to give any heat of wetting after being ignited, even though they may be ground extremely fine.

It has been found according to this method that the colloidal content of soils may range from 0 to as high as 80 per cent. of their weight and that the average soils contain a far larger amount of colloids than is commonly believed.

One of the interesting things that this method has revealed is the fact that the reactivity of material may not depend entirely upon the size of its particles but also upon the state of its activation. The latter may be due to several factors such as degree of decomposition, nature, etc. It would seem that the reactivity of the material may be more important than the size of its particles.

The procedure of the method consists of determining the heat of wetting of the soil, then extracting a certain amount of colloids from the soil and determining their heat of wetting. Knowing the heat of wetting of both the soil and the extracted colloids, the colloidal content can be readily calculated. It may be possible to ascertain the colloidal content of a soil by multiplying its heat of wetting with a factor, without having to extract the colloids.

The method of determining the heat of wetting is very simple, rapid and accurate and appears to be far superior to the vapor adsorption and dye adsorption methods.

Several other liquids besides water have been employed to determine the heat of wetting, but it was found that these other liquids did not react with all the different kinds of colloids in the soil, but water reacted with all of them.

A detailed report of the investigation is now in preparation.

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