SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN APPARATUS FOR DETERMINING THE PURITY OF LIMESTONE IN THE FIELD

THE wide distribution of lime deposits, the variability in the carbonate content of the deposits, and the wide-spread use of portable grinding equipment makes the perfection of an accurate field test, whereby the purity of the stone may be determined, highly desirable. McHargue[1] and Hopkins[2] have devised an apparatus for measuring the amount of carbon dioxide produced by treating the lime with an acid. The amount of apparatus required and the difficulties encountered in calculating the results have tended to limit the application of the method.

The author has devised an apparatus which will accomplish the same result, with the same degree of accuracy and within a period of ten minutes. The entire apparatus may be carried in a small kit weighing approximately eight pounds. The essential features of the apparatus are:

(1) A 25 x 250 mm Pyrex tube, graduated in such a manner that, by the use of standardized acids and alkalies, the percentage of lime (as pure $CaCO_3$) in the sample may be read directly.

(2) A standardized acid containing an indicator, and a standardized alkali of such strength as to correspond with the volumes indicated by the graduation on the tube.

(3) A modified hydrometer equipped with a removable pan on the tip, and so constructed as to float free in the graduated tube yet will be capable of weighing one gram of limestone with an accuracy of ± 2 per cent.

The sample is weighed by dropping it on the pan of the floating hydrometer until the proper point is reached. The tube is emptied and a definite quantity of acid added. The sample is then added and, after the violence of the reaction has subsided, the height of the liquid is adjusted to a definite volume. The contents are then boiled for five minutes over an alcohol flame. The volume is again adjusted and sufficient alkali added to produce the neutral point. The graduation at the height of the total volume shows the percentage of lime. A detailed explanation of the apparatus will appear later.

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A SIMPLE, QUICK AND INEXPENSIVE METHOD OF PREPARING LANTERN SLIDES

THE advantages of a quick method for preparing lantern slides which may be simply done and without the usual cost are especially valuable in the case of taking diagrams from a text or journal, or for producing necessary slides on short notice.

I have found the following preparation to have the above qualifications and to be very effective. Take a plain glass lantern slide, thoroughly clean it and allow to dry. When the slide has become quite dry apply a thin coat of albumin from a fresh egg and again allow the slide to dry. A smooth brush is essential in getting the coat of albumin evenly placed to avoid a streaked appearance when done.

As soon as the albumin has completely dried, place the plate with its coated side uppermost, over the diagram or other copy, and trace on the slide with India ink. The width of the lines may be varied by using pens of different sizes. Colored effects may be added in the same manner except that inks made from aniline dyes (such as the common writing fluids) should be used. The pigmentation in colored India inks make them all appear black on the screen.

Mount in the usual manner after the ink has dried by placing the newly made plate face down on another clean slide and fastening together with the usual lantern slide material or with adhesive tape.

These slides are not temporary as might be supposed but may be left in the lantern for long periods of time without injury in spite of the intense heat of some lanterns. I have used this preparation for the past five years and it is now being used by others in this department.

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SPECIAL ARTICLES

A NATURAL COPPER DEFICIENCY IN CATTLE RATIONS

A PRELIMINARY report was made at the recent meeting of the American Dairy Science Association in Davis, California, of a naturally occurring nutritional anemia of cattle in Florida. This anemia is caused by a deficiency of iron, or of iron and *copper* in the native vegetation growing on white or gray sand,

[1] J. S. McHargue, "County Agents' Calcimeter," Kentucky Agric. Expt. Sta. Circ. 9, 1915.

[2] C. G. Hopkins, "A Limestone Tester," Illinois Agric. Expt. Sta. Circ. 185, 1916.

Everglades muck, or Homestead marl soils. It does not occur on clay soils or on soils subject to overflow from clay lands. So far as known, this is the first natural copper deficiency reported.

Yearlings and heifers suckling first calves are most affected, although all ages suffer. It has been observed in sheep, goats and swine. Growth is retarded as much as one half. Reproduction is greatly impaired. This condition, known locally as "Salt Sick," has always been the cause of much loss to Florida's cattle industry. On some areas it has been impossible to keep cattle for any length of time.

Affected animals exhibit almost complete loss of appetite, emaciation, weakness and pale mucous membranes. Clay, sand, rags or dry weeds may be eaten when all feed is refused. Constipation and diarrhea in advanced cases are observed. The mortality rate has been high where cattle were not moved to healthy range or fed grain from an unaffected area.

Early workers at the Florida Agricultural Experiment Station described the post-mortem findings as identical with those of chronic tick fever (with which Salt Sick has been confused), except for the spleen. The spleen parenchyma is atrophied, the entire organ being about one quarter of its normal size. The hemoglobin of the blood often falls below four grams per cent., and the blood volume is reduced. All tissues are pale. The heart muscle is flabby and lacks tone. Otherwise the findings are those of extreme inanition.

Several hundred cases have been treated in the field. Three fluid ounces of a six per cent. solution of ferric ammonium citrate fortified with copper sulfate in molecular ratio of 50:1 given daily as a drench has been effective even in advanced cases. Two ounce doses are given to smaller animals. For prevention of the trouble and cure of less advanced cases, a lick made of 100 pounds of salt, 25 pounds of ferric oxide and one pound of copper sulfate given *ad libitum* has been found to be satisfactory.

Some hemoglobin determinations made in the field by means of a standardized Dare hemoglobinometer during the field work are as follows:

15 critical cases of salt sick	39.5 per cent.
87 visibly affected cases	60.3 " "
87 cases after one month treatment	77.2 " "
34 healthy animals in same herds	100.9 " "
185 healthy animals in unaffected areas	93.1 " "

Controlled feeding trials now in progress completely confirm the results of the field work. Iron supplements alone, even with the amount of copper present in *technical* chemicals, have proven inadequate. This may indicate a relatively high copper requirement in the bovine. Chemical and histological studies of all cases developed are being made. Tabulation of iron analyses of forage samples confirm the deficiency of iron, and copper analyses are being prosecuted.

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DECREASE IN RATE OF OXYGEN CONSUMPTION UNDER THE INFLUENCE OF VISIBLE LIGHT ON SARCINA LUTEA

FOR these experiments cultures of the micrococcus *S. lutea* were grown for twenty-four hours on 1 per cent. peptone agar. The organisms were then gently washed from the medium with distilled water, centrifuged rapidly, washed again and finally suspended in such a quantity of distilled water that there were approximately 5×10^8 cells in each cubic centimeter. Of this suspension, one cubic centimeter was pipetted into each of four reaction vessels of Warburg manometers;[1] one cubic centimeter was heated to boiling for a minute, made up to volume and pipetted into a fifth reaction vessel; the remainder of the suspension was used to inoculate new cultures and for other purposes. The reaction chamber of a sixth manometer contained one cubic centimeter of sterile distilled water. These vessels, into the side-arm of which a half cubic centimeter of normal base (NaOH) had been introduced, were then affixed to their respective manometers. The manometers were set in position in the water bath and allowed to shake for half an hour with open stopcocks, until temperature equilibrium. Then the stopcocks were shut; and since the base absorbed all the carbon dioxide excreted, the change in pressure registered by the manometers can be attributed wholly to the consumption of oxygen by the *Sarcina* in the closed system. The water bath was thermostatically controlled so that the temperature did not vary more than $\pm 0.02°$ C., during the course of any experiment. Illumination was provided by 10 60-w. frosted Mazda lamps arranged in two rows below the water bath, the light passing through the plate glass bottom of the tank and then nine inches of water before impinging on the reaction vessel. The two vessels in which we measured the oxygen consumption in the dark were wrapped in tin foil. The intensity of illumination was frequently controlled and found to be 556 ± 8 meter candles at the level of the vessels.

[1] O. Warburg, "Über d. Stoffwechsel d. Tumoren," 1926.