# MISSISSIPPI
# STATE GEOLOGICAL SURVEY

WILLIAM CLIFFORD MORSE, Ph.D.
Director

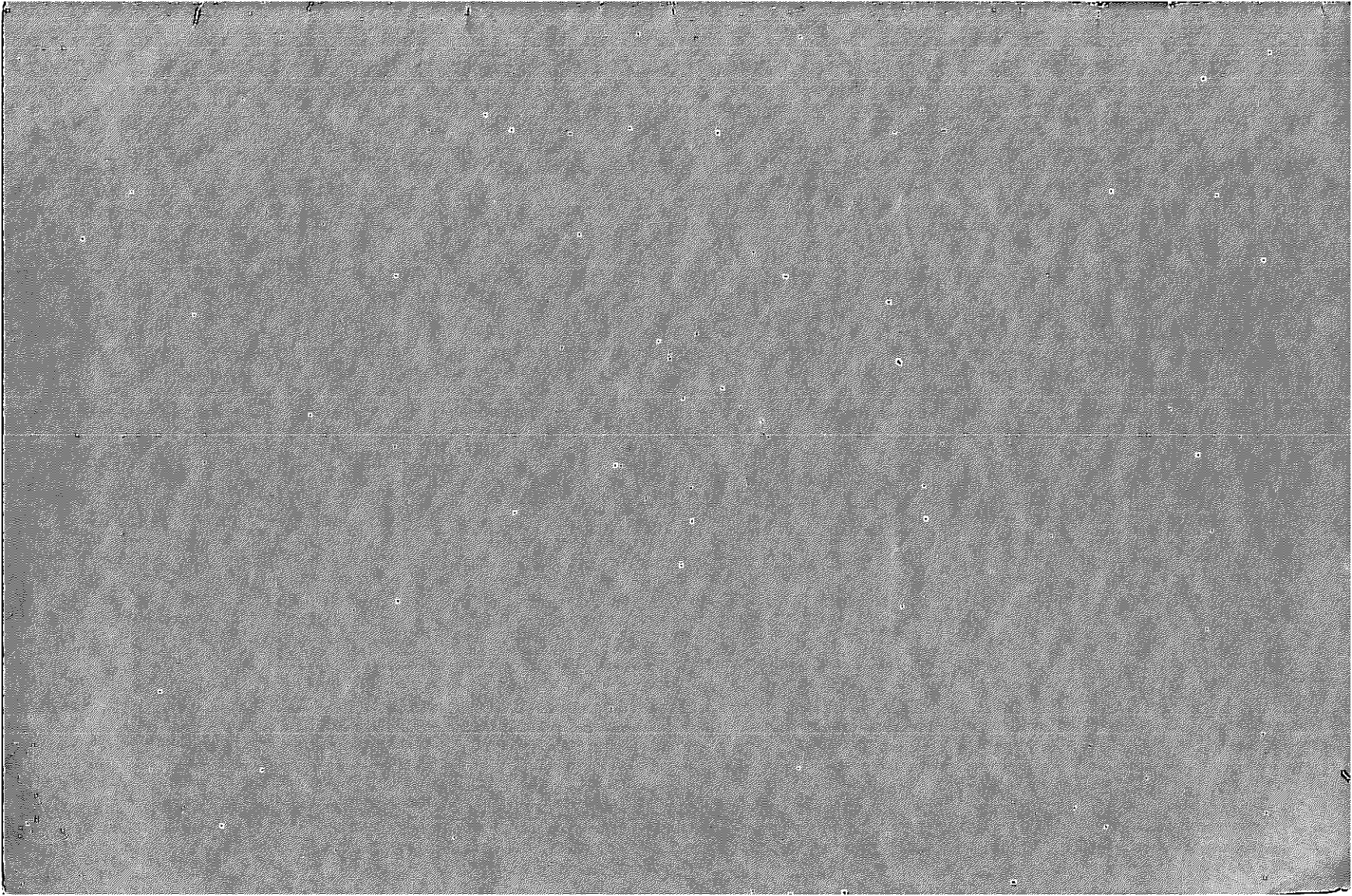

## BULLETIN 46

# MISSISSIPPI AGRICULTURAL LIMESTONE

By

FREDERIC FRANCIS MELLEN, M.S.

UNIVERSITY, MISSISSIPPI
1942



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## FOREWORD

Early in the summer of 1941, the Agricultural Adjustment Administration, Mr. T. M. Patterson, Administrative Officer in Charge, requested the Mississippi State Geological Survey to make an investigation of the limestones of Mississippi for agricultural lime. Although the field geologists, Mr. F. E. Vestal, Dr. H. R. Bergquist, and Dr. R. R. Priddy, could not be relinquished wholly from their supervisorship of WPA men on the county minerals survey, each of them was able to assist Mr. Frederic F. Mellen, who was employed as geologist in charge by the AAA during September and October to make the lime survey. Thus after a lapse of 20 years the State Geologist cannot refrain from expressing his gratification on being requested to make a survey of the agricultural limestones of the state, the use of which he, as a professor of geology, unsuccessfully urged so many years before; and on being able to furnish one of his former students to make this survey. He will be more than happy, though, if through the publication of this report, which he is undertaking without additional funds, he is able to save to the farmers of the state for merely the liming of the soils of their own farms the more than $1,000,000.00 in Federal funds, that is available only until August 31, 1942.—WILLIAM CLIFFORD MORSE.

## THE VALUE OF LIMING ACID SOILS

The use of ground limestone ($CaCO_3$) has doubled the yield of lespedeza, soybeans, and winter legumes on some soils in Mississippi. In addition to supplying calcium for plant food, lime helps to keep phosphorus in a form which is available to plants, and reduces the loss of potash by leaching. Consequently, over a period of years, less phosphorus and potash are required where a good supply of lime is maintained in the soil. The application of lime to strongly acid soils increases the calcium content of the grasses and legumes grown. When the calcium content of these plants is increased, they are more palatable to livestock, and they, in turn, produce more meat and milk.

In general, sandy soils are lower in lime than soils which contain more clay. The use of more than 1000 pounds of lime per acre often produces overliming injury on sandy soils. Over-liming injury can be avoided and the lime needs of crops can be supplied by applying 750 to 1000 pounds of ground limestone per acre every three years. Decreased yields due to the use of too much lime can be corrected by the use of five pounds of borax per ton of lime used.—W. B. ANDREWS.

# MISSISSIPPI AGRICULTURAL LIMESTONE

FREDERIC FRANCIS MELLEN, M.S.

## INTRODUCTION

Lime for agricultural purposes may be any one of a variety of chemical compounds, soluble, and therefore "available" as plant food. The principal and effective element is calcium, although magnesium is considered to be equivalent to calcium in its effect. The great calcareous deposits of Mississippi are, for practical considerations, exclusively in the chemical form of calcium carbonate, a non-caustic and stable compound, dominantly in the physical form of limestone, chalk, marl, or shell.

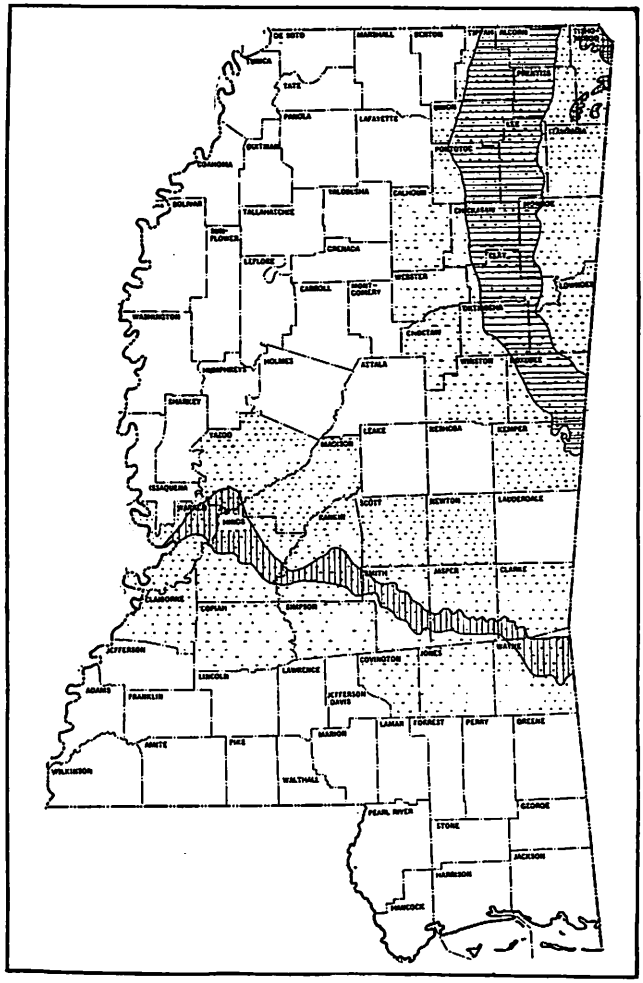
## GEOLOGIC AND GEOGRAPHIC DISTRIBUTION

Mississippi lime materials may be classified as follows: (1) hard crystalline high-calcium Paleozoic limestone of Tishomingo County; (2) chalk of the Selma and Prairie Bluff, varying in impurities such as sand, clay, mica, and pyrite; (3) marls of the Vicksburg formation, varying in impurities of sand and clay; and (4) hard non-crystalline or semi-crystalline limestone, generally high-calcium, of the Vicksburg formation.

Accessible lime carbonate in quantity and quality for commercial or semi-commercial development for agricultural lime is found in 18 counties, Tishomingo, Prentiss, Lee, Chickasaw, Clay, Lowndes, Oktibbeha, Noxubee, Kemper, Yazoo, Warren, Hinds, Madison, Rankin, Smith, Jasper, Clark, and Wayne. In each of these counties limes have been found in extensive and favorably situated deposits testing well above 70 percent calcium carbonate, the desirable minimum percentage for commercial use.

The hard crystalline and colitic limestones of Tishomingo County are the best materials available to a large area in north Mississippi, and are considerably higher in calcium carbonate than commercial ground limestones shipped into the state from Tennessee, Alabama, and Kentucky. Production problems are relatively simple, and have been worked out in central Kentucky, central Tennessee, and north Alabama for years. Unfortunately, the distribution area in Mississippi covers only a 90-degree arc from Tishomingo County.

The Selma chalk and the Prairie Bluff chalk of northeastern Mississippi offer the simplest production problems of any of the lime materials. Acre beyond acre in the Black Prairie has no



**Cross-lines:** Paleozoic crystalline limestones
**Horizontal-lines:** Selma and Prairie Bluff chalks
**Vertical-lines:** Vicksburg marls and limestones
**Stippled:** Areas that can be served

soil or other overburden to move. The deposits of massive, uniformly textured brittle chalk are so thick that 20 to 40 feet can commonly be worked by blasting.

In the case of the Vicksburg formation, it is generally true that an interval of approximately 10 to 30 feet of soft limestone or marl is found in the lower part, and that an interval of 30 to 40 feet of hard limestone beds interbedded with marls is found in the upper part. The softer materials are more abundant in

the eastern part of the state, and the harder materials, in the western. It is impractical for a large commercial agricultural lime plant to attempt development of the hard limestone alone, or of the marl alone; consequently, grinding equipment suitable for handling hard rock as well as gummy marl is needed. If in this manner the full Vicksburg lime section is used, a thickness of 35 or 40 feet can be worked in any county in which the Vicksburg crops out. The average composition of such a thickness in Warren County would be about 80 percent calcium carbonate, and in Jasper, Clark, and Wayne Counties, about 90 percent. The hard limestones may be produced separately, or the marls may be produced separately, by any small operator; but it would be difficult for such an operator to produce a well-maintained composition in his product by attempts at blending or grinding marls and limestones together. In cases where both limestones and marls are utilized by a small operator, it is generally desirable that two classes of product be maintained.

The marginal materials of the Yazoo clay, Moodys Branch marl, Wautubbee marl, Winona marl, Bashi marl, Clayton limestone, Owl Creek marl, and the Ripley formation are not considered as suitable materials for development.

## CHEMICAL COMPOSITION

Regardless of the form in which the lime materials of Mississippi are found, the chemical constituent is entirely calcium carbonate, consisting of a ratio of calcium oxide (quick lime) to carbon dioxide of 56 to 44, a proportion generally maintained whether the purity is 60 percent calcium carbonate or 90 percent calcium carbonate. Slight variations in this proportion might be noticed in Mississippi limes, due to small amounts of calcium oxide being combined with silica or phosphorus, or to small amounts of carbon dioxide being combined with magnesia, the magnesia (MgO) ranging from a trace to more than 2 percent of the sample.

In chemical quality, the agricultural lime materials, limestones, chalks, and marls, of Mississippi compare well with materials of other states, some being even better than the best materials now being imported. The color of lime is not a criterion of its quality; a small amount of iron hydroxide will commonly impart a dirty yellow or brown color to limestone, marl, or chalk, without impairing the value of the lime itself.

## PRODUCTION — OPERATORS

Lime for agricultural purposes is being produced in Mississippi at the time of the preparation of this report by a number of operators and will probably be produced by many other operators in the near future.

Operators:

Frank Dawson, Tishomingo, Tishomingo County
Reid & Fields, Tupelo, Lee County
Okolona Lime Plant, Okolona, Chickasaw County
Parker & Thigpen, Bay Springs, Jasper County
L. H. James, Sylvarena, Smith County
Magnolia Lime Co., Brandon, Rankin County
Madison County Lime Association, Canton, Madison County

These operators can furnish data on the quality of their products and on costs of delivery and can, in several instances, even produce higher quality lime by moving their plant sites to other deposits not far away, or by working different materials at the same sites.

Since the trucking cost of 70 percent lime is as great as 90 percent lime, the quality of the lime is of primary importance to the consumer who lives some miles away; and, for this reason, it may be to the advantage of a producer to utilize the highest quality material available.

Most of the liming that will be done in Mississippi will be during those months in which the roads are at their worst, consequently it is important that the lime be available and accessible on call at all times. It is important that every operator or prospective operator be sincere in his efforts to produce a steady stream of material. On the other hand, such an operator is due every consideration from the owners of lime deposits, from the county agricultural authorities, and from the farmers themselves. If he is to stay in business and prosper he cannot afford to pay high royalties for a material as common and cheap as an undeveloped lime deposit, and his bad accounts must be held to a minimum.

## CRUSHERS

In working the hard limestones of Tishomingo County and the Vicksburg formation in the counties in which it crops out, a hammer mill is being used. No tests have been made on high-calcium Selma chalk in these mills, but it is possible that Selma

chalk above 80 percent calcium carbonate would work well. Below 80 percent, preliminary drying is necessary before grinding in hammer mills can be accomplished without difficulty. Selma chalk is being crushed, after air-drying, in hammer mills at Tupelo and Okolona; at Bay Springs, Jasper County, a clay disintegrator is being used with great success by Parker & Thigpen, on a marl and soft limestone of the Marianna marl member of the Vicksburg formation. Large blocks of the Prairie Bluff chalk from the Morgan Stewart property west of Macon (77.56 percent $CaCO_3$) were run through this disintegrator with good results, and it is believed that roller crushers of this type would be the most successful in operating on the Selma and Prairie Bluff chalks, and on the Vicksburg marls, or on any other materials where the moisture content is sufficient to cause gumming of other machinery.

At prices varying from $370 to over $1000, hammer mills, which may be powered by electric motors, tractors, or gasoline engines of about 30 horsepower, are made by

O. B. Wise Co., Knoxville, Tennessee
Brooks Equipment & Manufacturing Co., Knoxville, Tennessee
Stover Manufacturing & Engine Co., Freeport, Illinois

Road jaw crushers, scattered over the state, have not yet been used successfully in preparing agricultural lime.

## CONSUMPTION

Calcium carbonate, the only form available from domestic sources, is the commonest form in which lime is applied to farm soils. Although early reports of the Mississippi Geological Survey mention lime kilns scattered over the state that produced burnt lime for building purposes until the railroads brought in a better material; now only calcium carbonate is produced for local consumption. In 1940 the United States consumed 165,764 tons of agricultural lime in the form of quicklime, 199,059 tons in the form of hydrated lime, and about 8,850,000 tons in the form of calcium carbonate, mostly crushed limestone.

## TABLES OF ANALYSES

The chemical analyses, all on dry basis, in Table 1 are of samples of materials from specific localities representing definite thicknesses, though not necessarily the full thickness or even the full workable thickness of the lime material. Many other localities may have just as good lime material, but obviously all such localities cannot be treated in such a brief report.

TABLE 1 Analyses of Mississippi agricultural limestones, September-October, 1941

| County | Owner | Sample | $CaCO_3$ | Thick. | Analysis |
|---|---|---|---|---|---|
| Alcorn | George King | M-11 | 42.78 | 12.0 | 172,484 |
| Chickasaw | Okolona Lime Plant | M-12 | 72.31 | 7.5 | 172,485 |
| | S. A. King estate | M-13 | 73.56 | 20.8 | 172,486 |
| | S. A. King estate | M-14 | 75.06 | 13.3 | 172,487 |
| | Jack Simpson | M-15 | 35.03 | 27.5 | 172,488 |
| | Jack Simpson | M-16 | 62.55 | 11.0 | 172,489 |
| | Edgar Corley | M-30 | 83.81 | 14.5 | 172,540 |
| Clay | Pete Winfield | C-1 | 83.07 | 30.0 | 172,505 |
| | Andrew Dexter | C-2 | 79.06 | 12.0 | 172,506 |
| | E. H. Walker | C-3 | 70.05 | 15.0 | 172,507 |
| | B. Moseley | C-4 | 62.55 | 20.0 | 172,508 |
| | Mrs. John Walker & M. Weber | C-5 | 83.07 | 30.0 | 172,509 |
| Hinds | W. P. Taylor | M-4 | 87.06 | 17.0 | 172,476 |
| Jasper | Parker & Thigpen lime plant | M-23 | 84.32 | 9.2 | 172,502 |
| | Allen Mixon | M-24 | 74.31 | 0-5′ | 172,503 |
| | | | 86.32 | 5′-8.5′ | 172,504 |
| Kemper | SE.1/4, Sec. 19, T.12 N., R.18 E. | M-6 | 77.56 | 9.0 | 172,478 |
| Lee | "Bill" Reigh | M-17 | 66.30 | 7.0 | 172,490 |
| | W. E. Stephenson | M-18 | 80.06 | 9.0 | 172,491 |
| | Reed & Fields lime plant | M-19 | 67.30 | 10.0 | 172,492 |
| Lowndes | Burgin Bros. | C-6 | 83.82 | 7.0 | 172,510 |
| | Burgin Bros. | C-7 | 77.56 | 15.0 | 172,511 |
| | Claude Pilkinton | C-11 | 77.81 | 15.0 | 172,515 |
| Madison | F. C. Brackett | M-3 | 85.06 | 19.0 | 172,475 |
| Monroe | Sec. 13, T.12 S., R.6 E. | V-1 | 96.58 | 3.0 | 172,523 |
| | NW.Cor. Sec. 27, T.14 S., R.6 E. | V-2 | 89.07 | ..... | 172,524 |
| | Sec. 5, T.15 S., R.7 E. | V-3A | 56.29 | ..... | 172,525 |
| | Sec. 5, T.15 S., R.7 E. | V-3B | 51.79 | ..... | 172,526 |
| | Sec. 9, T.15 S., R.7 E. | V-4 | 58.55 | ..... | 172,527 |
| | Sec. 26, T.15 S., R.6 E. | V-5 | 50.04 | ..... | 172,528 |
| Noxubee | Ed. Million | C-12 | 83.07 | 12.0 | 172,516 |
| | Morgan Stewart | C-13 | 77.56 | 11.0 | 172,517 |
| | Harrison Evans | C-14 | 73.56 | 14.0 | 172,518 |
| | Hugh Phillips | C-15 | 93.57 | 1.85 | 172,519 |
| | O. N. Boykin | C-16 | 72.56 | 15.0 | 172,520 |
| Oktibbeha | State | C-8 | 78.06 | 12.0 | 172,512 |
| | C. R. Stark | C-9 | 72.56 | 12.0 | 172,513 |
| | Julia Rogers | C-10 | 70.81 | 11.5 | 172,514 |
| Pontotoc | W. C. Dillard | P-1 | 59.80 | 12.8 | 172,522 |
| | Walter Donaldson | P-2 | 41.78 | 17.2 | 172,521 |
| Prentiss | Jim Gamble | M-25 | 73.81 | 8.0 | 172,535 |
| | Howard Wallace | M-26 | 63.05 | 20.0 | 172,536 |
| | Tom Carter | M-27 | 67.80 | 12.0 | 172,537 |
| Rankin | Magnolia Lime Company | M-7 | 76.81 | 12.0 | 172,479 |
| | Dewey Swor | M-8 | 71.06 | 11.0 | 172,480 |
| Smith | L. H. James | M-20 | 83.32 | 0-5′ | 172,493 |
| | | | 85.07 | 5′-8′ | 172,494 |
| | | | 81.06 | 8′-13′ | 172,495 |
| | | | 77.06 | 13′-15′ | 172,496 |
| | T. C. Waddell | M-21 | 82.82 | 0-5′ | 172,497 |
| | | | 80.31 | 5′-10′ | 172,498 |
| | | | 70.81 | 10′-12.7′ | 172,499 |
| | A. H. Longino | M-22 | 83.82 | 0-5′ | 172,500 |
| | | | 80.06 | 5′-7.5′ | 172,501 |
| Tishomingo | John Jourdan | M-9 | 89.57 | 9.0 | 172,481 |
| | Roe Daniels | M-9A | 91.07 | 9.0 | 172,482 |
| | W. A. & W. E. Reid; J. L. Bullard | M-10 | 98.18 | 40.0 | 172,483 |
| | Albert Farris | M-28 | 94.57 | 12.0 | 172,538 |
| | Frank Dawson | M-29 | 94.57 | 10.0 | 172,539 |
| Warren | J. W. Culley | M-1 | 89.59 | 8.0 | 172,473 |
| | Laura Archer | M-2 | 77.06 | 30.0 | 172,474 |
| Wayne | State Plant (not operating) | M-5 | 93.82 | stock | 172,477 |

TABLE 2. Analyses of limestone (L), chalk (C), and marl (M)—Crider's Report

| County | Page | Locality | CaO | $CaCO_3$ | Thick. |
|---|---|---|---|---|---|
| Alcorn | 44 | Corinth (C or M) | 26.37 | 47.09 | |
| Chickasaw | 49 | Okolona (C) | 45.51 | 81.27 | |
| | 49 | Okolona (C) | 45.62 | 81.47 | |
| Clarke | 66 | Near Nancy (L) | 36.62 | 65.39 | |
| | 66 | Near Nancy (L) | 45.51 | 81.27 | |
| Hinds | 63 | Byram (L) | 50.55 | 90.27 | |
| | 63 | Byram (M) | 27.77 | 49.59 | |
| | 58 | 1 mile south, Jackson (M) | 17.00 | 30.36 | |
| | 58 | 1 mile south, Jackson (clay) | 2.90 | 5.18 | |
| Kemper | 53 | 2½ miles east, Scooba (C) | ..... | 74.34(1) | |
| | 53 | 7 miles east, Sucarnochee (C) | ..... | 82.47(1) | |
| | 53 | 1½ miles south, Wahalak (C) | ..... | 68.91(1) | |
| Lee | 47 | 2½ miles south, Tupelo (C) | 34.31 | 61.27 | |
| | 47 | 1 mile west, Tupelo (C) | 32.89 | 58.73 | |
| Lowndes | 52 | Crawford (C) | ..... | 79.73 | |
| Noxubee | 51 | Macon (C) | ..... | 80.99(1) | |
| | 51 | Macon (C) | ..... | 76.71 | |
| | 51 | 3 miles north, Macon (C) | ..... | 83.88(1) | |
| | 52 | Prairie Rock (L) | ..... | 98.36(1) | |
| | 53 | 5 miles east, Shuqualak (C) | ..... | 84.61(1) | 50 |
| Oktibbeha | 50 | Not given (C) | ..... | 94.10(2) | |
| | 50 | Not given (C) | ..... | 94.35(2) | |
| | 50 | Not given (C) | ..... | 93.60(2) | |
| | 50 | Not given (C) | ..... | 94.07(2) | |
| | 50 | Not given (C) | ..... | 94.03(2) | |
| | 50 | Agricultural College (C) | 31.62 | 56.46 | |
| | 50 | Near Osborn (C) | 32.85 | 58.68 | |
| | 50 | 1 mile west, Starkville (C) | 38.65 | 69.02 | |
| | 50 | Howard Brick Yard, Starkville | 21.81 | 38.94 | |
| | 50 | Howard Brick Yard, Starkville | 29.29 | 52.30 | |
| | 50 | 1 mile east, Agricultural College | 40.02 | 71.46 | |
| Rankin | 64 | Near Plain (L or M) | 46.33 | 82.73 | |
| | 64 | Near Plain (L or M) | 52.12 | 93.07 | |
| | 64 | Near Plain (L or M) | 47.50 | 84.82 | |
| | 64 | Near Plain (L or M) | 39.75 | 70.98 | |
| | 64 | Near Plain (L or M) | 39.78 | 71.04 | |
| | 64 | Near Plain (L or M) | 29.87 | 53.34 | |
| | 65 | 4 miles southeast, Brandon (L) | 49.62 | 88.61 | |
| | 65 | 4 miles southeast, Brandon (L) | 49.92 | 89.14 | |
| | 65 | 4 miles southeast, Brandon (L) | 48.44 | 86.50 | |
| | 65 | 4 miles southeast, Brandon (L) | 48.40 | 86.43 | |
| | 65 | 4 miles southeast, Brandon (L) | 36.86 | 65.82 | |
| Tishomingo | 38 | "Devonian limestone" (L) | 23.25 | 41.52 | |
| | 38 | "Devonian limestone" (L) | 39.47 | (3) | |
| | 39 | Cypress Pond (L) | 52.75 | 94.59 | 30 |
| | 39 | Mingo Bridge (L) | 47.06 | 84.04 | |
| Warren | 61 | 2½ miles south, Vicksburg (M) | 34.20 | 61.07 | 5 |
| | 61 | 2½ miles south, Vicksburg (L) | 50.25 | 89.73 | 3 |
| | 61 | 2½ miles south, Vicksburg (L) | 47.50 | 84.82 | 5 |
| | 61 | 2½ miles south, Vicksburg (M) | 29.50 | 52.68 | 5 |
| | 61 | 2½ miles south, Vicksburg (L) | 49.97 | 89.23 | 5 |
| | 61 | 2½ miles south, Vicksburg (M) | 40.37 | 72.09 | 3 |
| | 61 | 2½ miles south, Vicksburg (L) | 50.63 | 90.41 | 3 |
| | 61 | Vicksburg (L) | 50.44 | 90.01 | 2 |
| | 62 | 2½ miles south, Vicksburg (composite L) | 50.11 | 89.48(4) | 16 |
| | 62 | 2½ miles south, Vicksburg (composite M) | 33.97 | 60.66(4) | 15 |
| Wayne | 67 | Red Hill (L) | 48.44 | 86.50(5) | |
| | 67 | Red Hill (L) | 44.58 | 79.61(5) | |
| | 67 | Red Hill (L) | 47.12 | 84.14(5) | |
| Yazoo | 58 | Yazoo City (M) | 14.62 | 26.11 | |

The chemical analyses in Table 2, reproduced for comparative purposes, are from Mississippi State Geological Survey Bulletin 1, Cement and Portland cement materials of Mississippi, by Albert F. Crider, 1907. Foot notes: (1) W. S. McNeil, analyst; (2) questionable analyses; (3) too high analyses; (4) A. M. Muckenfuss, analyst; (5) L. Harper, analyst; all other analyses by Mississippi State Chemical Laboratory ($CaCO_3$ ---equivalent).

TABLE 3. Analyses of limestone (L), chalk (C), and marl (M)—Hilgard's Report

| County | Page | Locality | CaO | $CaCO_3$ |
|---|---|---|---|---|
| Chickasaw | 97 | Houston (M) | 20.558 | 36.71 |
| | 101 | Okolona (C) | 45.791 | 81.77 |
| Clarke | 175 | Garlands Creek (M) | 14.785 | 26.40 |
| Hinds | 168 | Byram (M) | 43.932 | 78.45 |
| | 170 | Jackson (M) | 28.821 | 51.47 |
| | 170 | 3 miles north, Jackson (M) | 9.804 | 17.47 |
| | 170 | Mr. Langley's near Jackson (M) | 35.230 | 62.78 |
| Pontotoc | 103 | Stephen Daggett's (L) | 48.815 | 87.17 |
| Rankin | 172 | 4 miles south, Brandon (M) | 46.222 | 82.54 |
| | 185 | Yost's Lime-kiln near Brandon (L) | 52.474 | 93.70 |
| Tippah | 98 | Wilhite's, Sec. 27, T.2 S., R.4 E. (M) | 6.315 | 11.27 |
| | 99 | O. Davis', Ripley (M) | 7.952 | 14.20 |
| Tishomingo | 54 | Billing's Mill on Yellow Creek (L) | 23.247 | 41.51 |
| | 55 | Eastport (L) | 32.603 | 58.22 |
| | 56 | Cypress Pond (L) | 53.495 | 95.52 |

Mississippi State Geological Survey, E. W. Hilgard, analyst ($CaCO_3$—equivalent).

TABLE 4. Analyses of oyster shells

| County | Locality | $CaCO_3$ | Analysis |
|---|---|---|---|
| Harrison | Biloxi | 93.49 | 167,733 |
| | Biloxi | 94.01 | 11,318 |

Mississippi State Chemical Laboratory, analyst; L. I. Jones, collector of first sample.

TABLE 5. Analyses of commercial limestone shipped into Mississippi

| Through 10-mesh | Through 100-mesh | $CaCO_3$ | Analysis |
|---|---|---|---|
| 92 percent | 23 percent | 90.07 | 172,541 |
| 94 percent | 19 percent | 91.32 | 172,542 |
| 97 percent | 24 percent | 90.57 | 172,543 |

Mississippi State Chemical Laboratory, analyst.

### AAA REQUIREMENTS

Under present AAA requirements a ton of lime, the basis of soil building payments, is considered to be a 2000-pound ton of 90 percent calcium carbonate material, or 1800 pounds of calcium carbonate. If a chemical analysis is available, the actual weight of the material required can be computed simply by dividing the percentage into 1800. For example, an 87-percent calcium carbonate material ($1800 \div 87\% = 2069$) requires 2069 pounds to give the equivalent of 2000 pounds of 90 percent limestone. The pounds of certain other selected compositions required to equal one ton of 90 percent limestone are:

| Percent $CaCO_3$ | Pounds required | Additional Weight | Percent $CaCO_3$ | Pounds required | Additional Weight |
|---|---|---|---|---|---|
| 100 | 1800 | —200 | 70 | 2571 | 571 |
| 95 | 1895 | —105 | 65 | 2769 | 769 |
| **90** | **2000** | **none** | 60 | 3000 | 1000 |
| 85 | 2118 | 118 | 55 | 3273 | 1273 |
| 80 | 2250 | 250 | 50 | 3600 | 1600 |
| 75 | 2400 | 400 | 45 | 4000 | 2000 |

Unless otherwise stated, chemical analyses are usually made on a "dry basis," the samples being dried at a temperature just above the boiling point of water. In a very real sense water is just as much an impurity in agricultural lime as clay, sand, or iron oxide; but Federal specifications have yet to take this into account. Two tons of 45 percent marl or chalk might actually contain nearly 1000 pounds of water, making necessary a further proportionate increase in pounds required to equal one ton of 90 percent limestone. Although most higher grades of limestones contain a negligible amount of water, the poorer grades, particularly chalks and marls, contain more water.

## TISHOMINGO COUNTY

### SOUTHWARD POND

Limestone "A" of the Southward Pond formation is exposed in the north and west bluffs of the pond, four miles east-northeast of Tishomingo and one-half mile south of the Natchez trace, where it has a maximum thickness of 19 feet and an average thickness of 15 feet. A composite sample of 10 feet on the Frank Dawson property on the north side of the pond tested 94.57 percent $CaCO_3$; a composite sample of 12 feet on the adjoining Albert Ferris property, 94.57 percent $CaCO_3$; a sample by Hilgard years ago, 95.52 percent $CaCO_3$; a later sample by Crider,

94.59 percent $CaCO_3$—a remarkably chemically uniform oolitic limestone.

Producer: Frank Dawson, north side of Southward Pond (NW. 1/4, NW.1/4, Sec. 17, T.5 S., R.11 E.) ; hammer mill, powered.

#### CRIPPLE DEER CREEK

The Mississippian limestone, varying in texture from oolitic to coarsely crystalline to almost non-crystalline, is exposed along lower Cripple Deer Creek (Sec. 21, 22, 27, and 28, T.4 S., R.11 E.), where an interval of 50 feet lies above drainage and where a composite sample of 40 feet analyzed 98.18 percent $CaCO_3$—a limestone so pure as to require only 1834 pounds for an AAA ton of 90 percent lime.

Property: W. A. Reid and W. E. Reid (one-half mineral rights owned by J. L. Bullard).

The limestones of Tishomingo County are undoubtedly superior to limes of the other counties, are probably lower in natural water content than any other lime materials of Mississippi, and are the closest source of high-calcium materials for Alcorn, Tippah, Prentiss, and most of Itawamba Counties.

### LEE COUNTY

#### BUSFALOBA CREEK

The Demopolis member of the Selma chalk, exposed east of Belden in numerous and extensive outcrops along the south valley wall of Busfaloba Creek, seems to have two intervals of different qualities, the richer lower interval of 9 feet testing 80.06 percent $CaCO_3$, revealing the northern limit of the high-calcium facies of the Demopolis member, and an impure upper interval of 30 feet of sandy fossiliferous chalk. The rich lower 9-foot interval of the Demopolis member is sufficiently high in lime content to warrant transportation either by highway or by railway for long distances into all of Lee, Itawamba, Prentiss, Union, and Marshall Counties and into parts of Lafayette, Tippah, and Benton Counties.

Property: W. E. Stephenson, east of Belden (NE.1/4, SE.1/4, Sec. 9, T.9 S., R.5 E.).

## CHICKASAW COUNTY

### OKOLONA

Selma chalk of the highest quality underlies the town of Okolona and crops out within the city limits and just without these limits. A composite sample of 14.5 feet of hard chalk, M30, from the Corley property above the level of Highway 45 W at its intersection with 41 at the northwest edge of town, shows 83.81 percent $CaCO_3$, which is 11.5 percent higher than that being produced by the Okolona Lime Plant and nearly 10 percent better than that produced by the old Penitentiary plant on Stone Switch (State Chem. Lab. analysis 73.86 percent $CaCO_3$ in Booklet by Penitentiary Trustees). Selma chalk samples from Okolona gave Hilgard 81.77 percent $CaCO_3$ and Crider 81.27 and 81.47.

Producer: Okolona Lime Plant, Highway 45 W and 41, Gulf, Mobile, and Ohio Railroad.
Property: Edgar Corley.

## CLAY COUNTY

### CEDAR BLUFF

The high-calcium facies of the Demopolis member of the Selma chalk is exposed at Cedar Bluff, the most westerly high-calcium chalk deposit in the area. A 30-foot composite sample of the chalk from the Pete Winfield property analyzed 83.07 percent $CaCO_3$; samples from adjoining property of Williams Brothers, 86.13, 87.48, and 85.06. This chalk is most accessible to portions of Chickasaw, Calhoun, Webster, Montgomery, and Oktibbeha Counties, and possibly to Carroll, Leflore, Sunflower, Washington, and Bolivar Counties, farther west.

Property: Pete Winfield, Highway 10, 1 mile from Columbus and Greenville Railway.

## LOWNDES COUNTY

### BURGIN JUNCTION

The Demopolis member of the Selma chalk, a few feet above the *Diploschiza cretacea* zone, is exposed on the Burgin property on U. S. Highway 82, 3/4 mile west of its junction with 45 W in Lowndes County, adjoining Oktibbeha. A composite sample from the 15-foot outcrop of the chalk, C7, analyzed 77.56 percent $CaCO_3$; a sample from a 7-foot auger hole, C6, below, 83.82; an average for the 22 feet of 78.79, necessitating a 2285-pound

AAA ton. However, by working only the lower interval, and possibly by working below the 7-foot auger hole, the quality can be held to a slightly higher level. The deposit of chalk, because of its location 5 miles northwest of Crawford, 14 miles west of Columbus, 10 miles south of West Point, and 8 miles east of Starkville is strategically located for development to serve Lowndes County and part of Clay and Oktibbeha Counties.

Property: Burgin Brothers (SW.1/4, SW.1/4, Sec. 30, T.19 N., R.16 E.), U. S. Highway 82, 3/4 mile from 45 W, 2 miles from the Gulf, Mobile, and Ohio Railroad Mayhew Station.

## OKTIBBEHA COUNTY

### STARKVILLE

The Prairie Bluff chalk is exposed around Starkville and westward. A composite sample of 12 feet of the chalk, C9, from the Stark property analyzed 72.56 percent $CaCO_3$, necessitating a 2481-pound AAA ton as compared to a 2285-pound AAA ton on the Burgin property 10 miles to the east, a handicap that might be overcome by the nearby exclusively acid soils of the Flatwoods and North-Central Hills areas to the west.

Property: C. R. Stark, U. S. Highway 82, 1½ miles west of Starkville.

## NOXUBEE COUNTY

### MACON ENVIRONS

The Prairie Bluff chalk in an outcrop 6 miles west of Macon (Highway 14) is the most accessible lime deposit to large areas in the Flatwoods and North-Central Hills of Noxubee and Winston Counties. The chalk, C13, analyzed 77.56 percent $CaCO_3$, a better quality than farther north (C16, 72.56; C10, 70.81; C9, 72.56), requiring a 2321-pound AAA ton. The Prairie Bluff chalk at this place might possibly have to compete with the Selma (Demopolis member) chalk at Macon where a 50-foot interval tests 80.00, requiring only a 2250-pound AAA ton.

Property: 6 miles west of Macon, Highway 14 (paved 25 miles to Louisville).

## KEMPER COUNTY

### SCOOBA

The Prairie Bluff chalk is exposed along U. S. Highway 45 at a point 3 miles northwest of Scooba and 3 miles southeast of Wahalak, where a 9-foot composite sample of the chalk, M6, analyzed 77.56 percent $CaCO_3$, necessitating a 2321-pound AAA ton. Although the chalk can be worked to a greater depth, this 9-foot chalk interval in the one small hill would yield 15,000 cubic yards by the removal of not more than 5 feet of overburden—and even this overburden contains 50 percent $CaCO_3$, which would be used advantageously on the Flatwoods farms within a radius of 2 or 3 miles. Other hills, both east and west, show even greater quantities. The chalk in this area is the most favorably located deposit for Lauderdale, Neshoba, and Kemper Counties.

Property: Hill (NW.1/4, SE.1/4, Sec. 19, T.12 N., R.18 E.), 1/4 mile from the Gulf, Mobile, and Ohio Railroad, U. S. Highway 45, State Highway 16, which is gravelled through the Flatwoods.

## WARREN COUNTY

The Vicksburg marls and limestones on the Laura Archer property, on Highway 3, 22 miles northeast of Vicksburg, cap a long narrow well-drained ridge. The marls and limestones have a workable thickness of approximately 30 feet, an estimated quantity of 375,000 cubic yards, and an overburden ranging from 1 to 30 feet but averaging about 10 feet. These marls and limestones in sample M2, from a ravine ½ mile southeast of the property, analyzed 77.06 percent $CaCO_3$, perhaps typical of the material on the property, which is the most workable in the entire county and from which distribution can be made to all the counties of the lower Delta, particularly Yazoo and Warren.

The Vicksburg marls and limestones, sample M1, on the J. W. Culley property, 11 miles south of Vicksburg, near U. S. Highway 61, analyzed 89.59 percent $CaCO_3$, which may be a trifle high, for only an 8-foot interval could be sampled. These marls and limestones, having a recoverable quantity of 50,000 cubic yards, are the only deposit of lime in south Warren County and

the most accessible to Claiborne, Jefferson, Adams, Franklin, Wilkinson, and Amite Counties.

The slightly limy greensand marls constituting the lower Vicksburg in Warren County differ from the soft limestones or highly calcareous marls constituting the lower Vicksburg in eastern Hinds County and farther east and agricultural lime, consequently, cannot be worked in pits like the one north of Brandon without a good bit of blasting and grinding of the limestone beds. Careful blending of all strata is particularly advisable in Warren County unless the hard limestone alone is used.

## MADISON COUNTY

### MADISON STATION

The Vicksburg limestones and marls constitute a series of outliers that cap the hills some 5 miles west of Madison Station and 12 miles north of Jackson. These limestones and marls from a 19-foot face at this place, sample M3, analyze 85.06 percent $CaCO_3$, necessitating a 2118-pound AAA ton, and have an estimated quantity of 80,325 cubic yards on the Kahn property and 56,350 cubic yards on the Brackett property, and a maximum overburden of 10 feet. These limestones and marls, lying midway between U. S. Highways 49 and 51 but requiring the construction of a ½ mile road, are the most accessible materials for Holmes, Attala, Leake, and Madison Counties, and for large contiguous portions of Hinds and Yazoo Counties.

Producer: Madison County Lime Association (B. H. Jones of Canton), 16th section land about 1 mile southwest of the Kahn Brackett property; capacity, 40 tons of ground rock daily.

## HINDS COUNTY

### CLINTON

The Vicksburg limestones and marls, as represented by a composite sample, M4, from 13 feet of marl, "chimney rock," and 4 feet of overlying hard limestone, analyze 87.06 percent $CaCO_3$ and have an estimated quantity of several hundred thousand cubic yards—a sufficient quantity to serve all of Hinds County and the counties to the south.

Property: W. P. Taylor (NE.1/4, SW.1/4, Sec. 1, T.15 N., R.2 W.), on Bakers Creek 3 miles southwest of Clinton and ½ mile north of the Yazoo and Mississippi Valley Railroad.

## RANKIN COUNTY

### BRANDON

The Vicksburg limestones and marls, lying above the quarry floor of the Forest Hill member of the Jackson formation, consist of 12 feet of Mint Spring marl and 22 feet of overlying alternate hard limestone and softer marl. The Mint Spring marl, as represented by a composite sample from the 12-foot quarry face, analyzes 76.81 percent $CaCO_3$, necessitating a 2342-pound AAA ton. The upper limestones and marls are higher grade materials, for the production of which the installation of machinery is planned.

Producer: The Magnolia Lime Company of Brandon, quarry (SE.1/4, Sec. 34 and SW.1/4, Sec. 35, T.6 N., R.4 E.), 6.4 miles from the Brandon courthouse and 5.7 miles from the railroad.

## SMITH COUNTY

### SYLVARENA

The Vicksburg limestones and marls are favorably located for commercial development in the vicinity of Sylvarena on the L. H. James, the T. C. Waddell, and the A. H. Longino properties, where two samples from a 7.5-foot section of marl on Tallahala Creek, 1.8 miles southeast of Sylvarena, revealed an average composition of 82.57 percent $CaCO_3$ and a quantity of 100,000 cubic yards, having a maximum overburden of approximately 5 feet on a 2-acre area.

Producer: L. H. James.

## JASPER COUNTY

### BAY SPRINGS — HEIDELBERG

The Vicksburg limestones and marls extend from western Jasper County near Bay Springs to the southeast corner of the county near Heidelberg.

The marl from a composite sample of 9.2 feet of material from the Parker and Thigpen quarry 4 miles northwest of Bay Springs analyzes 84.32 percent $CaCO_3$, necessitating a 2134-pound AAA ton, and is available as a liming material for western Jasper County, and for Newton County.

Operator: Parker & Thigpen (NW.1/4, Sec. 19, T.2 N., R.10 E.), on a poor road 4 miles northwest of Bay Springs, the closest

rail shipping point; No. 2 disintegrator (J. C. Steele & Sons, Statesville, N. C.), truck power.

The marl or "chimney rock" from a top 5-foot sample and from an underlying 3.5-foot sample from the Allen Mixon property 1¼ miles southeast of Heidelberg analyzed 74.31 percent $CaCO_3$ and 86.32 percent $CaCO_3$, respectively, and another sample (R. W. McInnis sample 172,167) from the same property, across the road, analyzed 87.00 percent $CaCO_3$—all the marl being favorably located for supplying eastern Jasper, parts of Wayne, Clarke, and Lauderdale, and all of Jones and other counties southward.

Property: Allen Mixon, 0.3 mile northwest of U. S. Highway 11; requires a clay disintegrator for the marl, a hammer mill for the limestone.

## WAYNE COUNTY

### WAYNESBORO—HIWANEE

The Vicksburg limestones and marls from a stock sample, M5, from the State Penitentiary agricultural limestone pit, 4 miles by road north of Waynesboro, analyzed 93.82 percent $CaCO_3$; nevertheless, this high grade material could not profitably maintain the State Penitentiary Agricultural Limestone Plant (W. edge Sec. 25 and E. edge Sec. 26, T.9 N., R.7 W.), probably because of the location of the pit in a deep ravine, the excessive overburden, and the nearly impassable road for a distance of 0.8 mile west of U. S. Highway 45, despite the proximity of the Gulf, Mobile, and Ohio Railroad.

The Vicksburg limestones and marls, on the Jim Stanley property (NE.1/4, Sec. 23, T.10 N., R.8 W.) in the northern edge of the county approximately 5 miles west of Hiwanee, are estimated to have 90.00 percent $CaCO_3$, a million cubic yards of material, and little overburden.