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Diatomite in the High Plains Region of Texas

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Diatomite, or diatomaceous earth, occurs in several widely separated localities in the High Plains region of west Texas. Reference to occurrences in Crosby and Dickens counties was made by W. F. Cummins[1] in 1892 and by subsequent writers in reports dealing with the Blanco beds of Crosby County. In the course of field work carried on in recent years by Grayson E. Meade and the writer, further observations have been made of the Crosby County deposits, and new deposits, announced in this publication, have been discovered by them in Armstrong, Ector, and Hartley counties. This paper describes the several known deposits so far as present knowledge permits and discusses possibilities of commercial production.

Diatoms are unicellular aquatic plants, both the living and fossil forms of which are almost universally distributed. Diatoms grow profusely in both fresh and salt waters, and under favorable conditions the siliceous diatom skeletons may accumulate in such quantities as to form diatomite deposits. Diatomite is an extremely light weight, friable material, weighing when dry only 15 to 40 pounds per cubic foot in its natural compacted form. The low apparent specific gravity is due to the great proportion of void spaces between and within the individual skeletons. In composition diatomite is predominantly opaline silica, but smaller quantities of organic matter and compounds of such elements as calcium, aluminum, and magnesium are present in almost all deposits. In a dry and nearly pure state diatomite is white, ivory, or light gray in color, but darker shades resulting from contained impurities are also common in unrefined material.[2]

The unusual physical properties and relative chemical inertness of diatomite make it a useful material in many industrial applications. The most important uses are for filtering, particularly of cane sugars, thermal insulation, admixtures or fillers, and abrasives. The United States is the leading diatomite producing and consuming country. Most of the production is derived from exceptionally large and pure deposits in California, Oregon, and Washington, although production is also carried on in other western states and in several states along the Atlantic seaboard.

The diatomite deposits known in west Texas were laid down in shallow, fresh-water lakes or ponds which existed in the region during parts of the Pliocene and Pleistocene epochs. These old lakes are so completely filled with sediments as to be unrecognizable except where they are being dissected by headward-eroding valleys. It is probable that a number of filled lakes, which may contain diatomite deposits and are not yet recognized, are present in the High Plains.

Armstrong County

Diatomite deposits occur at three or more horizons in late Cenozoic deposits on the north side of Mulberry Canyon about 7.4 miles southwest of Goodnight. The exposures extend for 2 miles or more along and near the east-west division fence between the J. T. McGehee and Oscar Cobb ranches. The deposits lie on both sides of the Goodnight to Wayside cross-canyon road. The strata containing the diatomite deposits strike nearly east-west and dip southward from 5 to 20 degrees. The sediments consist mainly of soft, light greenish-gray sands with thin clay lentils and two beds of fresh-water limestone near the top of the section. The best diatomite deposits occur high in the section, between and below the fresh-water limestones. The strata rest upon older and more indurated Pliocene rocks and may be either Pliocene or Pleistocene in age.

The comparatively resistant limestone beds support low hogback ridges which are transected by several south-flowing tributary branches of Mulberry Creek. The best exposures of diatomite have developed on the freshly eroded slopes of the tributary valleys. Along the ridge segments between the tributary branches, the diatomite beds are largely concealed beneath soil and vegetation. Due to the lack of more extensive exposures it has not been ascertained whether the deposits originally lay in continuous beds or in a series of lenses reappearing at approximately the same horizons. The deposits vary in thickness along the strike from less than 2 feet to as much as 7 feet, the average thickness being perhaps 3.5 to 4.5 feet. The deposits dip southward and pass beneath later alluvium within a distance of a few hundred feet from the outcrop. Erosion prior to the deposition of the alluvium has destroyed much of the down-dip portion of the deposits, but it is possible that some large segments of the diatomite beds may be preserved within the higher alluvium-covered ridges.

The diatomite ranges from nearly pure white to light gray in color. It is massively bedded but is locally faintly laminated in parts of the deposits. In some weathered exposures sands and calcareous material have entered the deposits along joints and root channels; these impurities, however, do not appear to extend into the deposit beyond the weathered zone except in relatively minor quantities. The following analysis, by R. M. Wheeler of the Bureau of Economic Geology, is a sample taken one-fourth mile west of the Goodnight-Wayside road on the McGeehee ranch. The sample was dried prior to analysis, and analysis was for major constituents only.

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[1]Cummins, W. F., Report on the geography, topography, and geology of the Llano Estacado or Staked Plains, with notes on the geology of the country west of the plains: Texas Geol. Survey, 3d Ann. Rept., 1891, pp. 143-144, 1892.

[2]References consulted in the preparation of this paper are: Calvert, Robert, Diatomaceous earth: Amer. Chem. Soc., Mon. Ser. 52, 1930; and Cumins, A. B., and Mulryan, Henry, Diatomite, *in* Industrial Minerals and Rocks, pp. 243-260, 1937.

Chemical analysis of diatomite sample from Armstrong County, Texas.

	Per cent
Ignition loss	6.36
Silica	79.94
R_2O_3 (oxides of aluminum and iron)	7.80
Calcium oxide	1.24
Magnesium oxide	1.62
Total	96.96

Crosby County

Diatomite deposits occur at two horizons in the Blanco beds near the junction of White River Canyon and Crawfish Draw 10 miles north of Crosbyton. The deposits are on the J. S. Bridwell ranch, from 500 to 2500 feet east of a north-south fence separating the Bridwell and Ralls ranches, and from 0.4 to 0.8 mile south of the Cone—Mt. Blanco road. The Blanco beds which contain the diatomite deposits are 60 to 70 feet thick and consist mainly of light gray calcareous sands and clays. The beds outcrop high on the valley slopes on both sides of White River Canyon and extend for a short distance along the valley walls of Crawfish Draw. The Blanco rests by irregular contact on reddish-brown strata of middle Pliocene age. Sharply contrasting colors of the Blanco and the underlying Pliocene provide a conspicuous contact useful in locating the position of the diatomite deposits. The diatomite horizons lie respectively about 25 and 42 feet above the contact. The diatomite occurs in only one relatively restricted part of the exposed area of the Blanco beds.

The deposits are in flat-lying lenticular beds attaining a maximum exposed thickness of about 6 feet and thinning irregularly to 1 foot or less. Outcrops can be traced continuously for distances of from 200 feet to as much as 1000 feet. In the thicker portions of the deposits the diatomite is relatively pure, but in parts of the thinner marginal portions a high percentage of calcium carbonate is present. Most of the diatomite is massive and sufficiently compacted to form vertical faces on freshly eroded bluffs. Undulations on the surface of the deposits were apparently produced by weak currents or wave action and account in part for local inequalities in the thickness. The overburden increases from the outcrop to a maximum of about 40 feet above the lower bed and 16 to 20 feet above the upper bed.

The following analyses, made by R. M. Wheeler of the Bureau of Economic Geology, indicate the quality of the diatomite. Sample No. 1 is from the upper horizon; sample No. 2 is from the lower horizon. Both samples were dried at 105° C. prior to analysis. The analyses are for major constituents only and do not include tests for such elements as sodium and potassium which may be present in small amounts.

Chemical analyses of diatomite samples from Crosby County, Texas.

	Sample No. 1	Sample No. 2
	Per cent	
Ignition loss (carbon dioxide, organic matter)	7.43	6.79
Silica	81.08	80.62
R_2O_3 (aluminum and iron oxides, not separately determined)	6.00	7.08
Calcium oxide	0.62	0.72
Magnesium oxide	2.04	1.99
Total	97.17	97.20

Dickens County

W. F. Cummins[3] reported two beds of diatomaceous earth at a locality along the breaks of the plains about 4 miles north of old Dockum in western Dickens County. The section below is reproduced from Cummins' report.

Section 13.	Feet
1. White sandy clay	6.0
2. White diatomaceous earth	3.0
3. Purple clay	3.0
4. White diatomaceous earth	4.0
5. Reddish sandy clay	150.0

One effort to relocate the measured section was unsuccessful, although some sandy calcareous material containing diatoms was seen at approximately the same horizon as No. 4 of the above section.

[3] *Op. cit.*, p. 144.

Ector County

A deposit of impure diatomaceous earth is exposed in the bottom of a road material pit adjacent to the southeast side of U. S. Highway No. 80 in western Ector County about 700 feet from the Ector-Crane County line. The diatomite contains calcareous and clayey materials and locally numerous fossil snails and sedge stems. Thin efflorescent crusts of salts, probably sulphates of calcium and sodium, form on the exposed surface of the bed. Inasmuch as the pit workings expose only a small area and do not penetrate the full thickness, the extent of the deposit can be determined only by borings or test pitting.

This deposit lies within a belt of recent and ancient sand dunes which extends across several west Texas counties into southeastern New Mexico. In some of the larger blow-out depressions between dune ridges, ephemeral lakes of clear water form during periods when the local water table rises above the base level of dry-stage wind erosion. These lakes provide a temporary favorable environment for diatom growth, and it seems probable that the diatomite deposit accumulated in a similar lake or pond during one of the relatively prolonged humid stages of the Pleistocene. Other diatomite deposits which may exist within the dune belt area are most likely to be discovered in the recent blow-out excavations which at numerous places cut through the dune sands into underlying sediments.

Hartley County

Diatomite deposits are exposed at two localities on the J. L. Bivens ranch about 3.5 miles south-southeast of Channing. The localities may be reached by going 2.2 miles south from Channing on the Tascosa road, then southeastward on a pasture road for about 1.2 miles to a point where an east-west fence crosses a large intermittent creek. The diatomite exposures are located respectively on the west creek bluff about 1000 feet downstream (southward) and on the east creek bluff about 2500 feet downstream from the fence crossing.

In each of tbe exposures the diatomite occurs in a single bed 3 to 3.8 feet in thickness. The beds enclosing the diatomite deposits dip 10 to 16 degrees in a south-southeast direction. The following section was measured at the exposure on the west bluff; the exposure on the east bluff lies stratigraphically considerably above the measured section.

Section on J. L. Bivins ranch, Hartley County, Texas.

	Thickness in feet
6. Fresh-water limestone; contains casts of small pelecypods and gastropods. This bed forms the cap rock of a low hogback ridge	2.0
5. Bentonitic clay, greenish-gray, soft	3.0
4. Sand, cream-colored, soft	5.5
3. Diatomite, light gray to buff, calcareous; contains some pond snails and fragmentary fossil bones; friable, lower contact undulating	3.5
2. Sandy clay	2.0
1. Calcareous sands. To creek bed	8.5

Fragmentary fossil teeth found in the sand bed overlying the diatomite indicate the beds to be of Pliocene age.

The area in which the Hartley County diatomite deposits occur in almost completely covered by soil and vegetation, good bed rock exposures being found only in occasional meander bluffs immediately adjacent to the stream channel. It is not possible, therefore, to determine the extent of the diatomite, nor of the lake basin in which it appears to have been deposited, without the aid of test pits or borings. It is possible that the diatomite beds extend laterally into thicker and purer deposits, as there is no good reason to assume that the best or average parts of the deposits would be revealed in the limited exposures of the region.

The diatomite contains some sand and calcareous materials and, particularly in the east bluff exposure, an abundance of thin-shelled fossil gastropods and pelecypods. The analysis given below, made by R. M. Wheeler of the Bureau of Economic Geology, is of an average sample taken from the east bluff exposure.

Chemical anlysis of diatomite sample from Hartley County, Texas.

	Per cent
Ignition loss	17.83
Silica	54.64
R_2O_3 (oxides of aluminum and iron)	4.04
Calcium oxide	19.88
Magnesium oxide	1.27
Total	97.65

Economic Considerations

It will not be possible to appraise accurately the economic value of the west Texas diatomite until the character and extent of the several deposits have been determined by testing. However, the deposits which on surface exposures appear to offer best possibilities of development are those in Armstrong and Crosby counties.

The quantity of diatomite which might profitably be produced from the Armstrong and Crosby County deposits is dependent in part on the price which finished grades will command and on mining, milling, transportation, and other operational costs. If specialty grades, which command a much higher price, can be developed, a larger proportion of the total quantity could be produced than

would otherwise be possible. Some thousands of tons could be obtained at comparatively low costs along narrow strips paralleling the outcrops where overburden is light. Beyond the outcrop zone the overburden increases, and mining costs would be proportionately higher.

The quality of diatomite is dependent upon its physical and chemical properties, although its suitability to the different uses may be finally determined by its actual performance in the industries. Most of the Armstrong and Crosby County diatomite is friable enough to be pulverized by mild pressures but is sufficiently compact to permit sawing or shaping into bricks or blocks. The material is comparatively free to harsh extraneous matter. Chemical analyses given on preceding pages compare favorably with commercial diatomites of the country.

Any production of the known Texas diatomite will necessarily be confined to relatively small-scale operations because of limitations in the quantity of material that can be cheaply obtained. Some of the producing deposits, particularly those in the western United States, contain almost inexhaustable reserves of good-grade diatomite and are capable of being mined by economical large-scale methods. The Texas deposits can not be expected to compete with established sources except within a restricted market range where considerably lower transportation costs offer a competitive advantage.