SHELL MARL.

324. Received from Mr. Nathan Hart, West Cornwall, Oct. 22d.

Moisture	23.72
Silica, sand and insoluble matter,	16.88
Oxide of iron and alumina,	1.55
Lime,	27.99
Magnesia,	.97
Soda,	.59
Potash,	trace
Sulphuric acid,	.46
Phosphoric acid,	trace.
Carbonic acid,	21.77
Organic matter* by difference,	5.87
	100.00
*Containing organic nitrogen,	0.44

This shell marl consists of *carbonate of lime* to the extent of 40 per cent. and contains 2 per cent. of *carbonate of magnesia*, also 0.9 per cent. of sulphate of soda, and 0.25 per cent. of carbonate of soda. The organic matter includes nearly 0.5 per cent. of nitrogen, in organic combination.

Mr. Hart informed the Station, that parties, whose names were not given, proposed to put this marl on the market as a fertilizer at the price of $15 per ton.

There can be no doubt that its employment, in liberal quantities, viz: one or more tons per acre, especially upon grass lands, would often be attended with decided and long-continued benefit but, in most cases, its action upon grain crops would not appear at once in so decided a manner as is very commonly the case with good superphosphates or guanos.

The fertilizing effects of this shell marl as well as its commercial value may be safely measured by the percentage of lime which it contains. Its effects on crops would be in general quite similar to those of oyster shell lime although somewhat less pronounced since carbonate is a less energetic agent than hydrate of lime. Its content of lime, 28 per cent., is less than one-half as much as that of the two samples of slacked lime which are described below.

The only drawback to the use of the marine mud lies in the considerable proportion of soluble salts, mostly common salt, which it contains, being nearly one per cent. If thrown out in heaps and exposed to the rain this salt will be mostly removed. The mud may also be applied directly to the root crops or grass in moderate quantities without damage, if well distributed.

As an *amendment* the fine mud must have an excellent effect on coarse-textured soils.

OYSTER SHELL LIME.

The three accompanying analyses exhibit the composition of samples of oyster shell lime and screenings made by H. A. Barnes & Co., Fair Haven. The samples were taken on Nov. 24th, 1879, by Dr. Armsby, with the assistance of Mr. Barnes, who has also supplied the following data descriptive of the samples.

328 is unscreened oyster shell lime, slacked the day the sample was drawn.

329 is unscreened oyster shell lime, slacked, and about six months old.

330 is oyster shell lime screenings.

The two samples of slacked lime are fine and in good condition to apply to land, **328** being quite dry in handling, **329** damp and coherent.

The slacked and unscreened lime which these two samples represent is sold by measure and not by weight. The price, in November, 1879, was 8 cts. per bushel at the work, and 9½ cts. per car load, shipped in bulk at R. R. Depot. The average weight of the screened slacked lime used for building purposes is stated to be 47 pounds per bushel. As the screenings amount to 3 to 5 per cent, of the total, it is not far from the truth to assume that the unscreened will weigh 50 pounds per bushel. The cost of this lime would be accordingly 16 cents per 100 pounds, at the kilns, or $3.20 per ton. Shipped in casks

samples of lime contain about 9 per cent. of sand and coal or of substances mostly derived from them, viz: oxide of iron, alumina, and silica. We have small quantities of potash, soda, magnesia, phosphoric and sulphuric acids, altogether amounting to 1.5 per cent. Both samples contain also nearly equal quantities of carbonic acid, viz: 8.3 per cent. Lime, the chief ingredient, varies from 64.5 to 53.6, or nearly 11 per cent., and water from 17 to over 28, also 11 per cent.

Looking now to the statement of the proportions of the compounds probably existing in the samples, we see that in the two samples of slacked lime the chief ingredient is hydrate of lime (or calcium hydroxide) next to this in quantity comes carbonate of lime (or calcium carbonate) followed by silicate of lime 4.05 per cent., sulphate 1.03 per cent., and phosphate 0.4 per cent.

A brief review of the chemistry of the lime manufacture may be serviceable. Clean oyster shells consist chiefly of carbonate of lime. As they are used in lime manufacture they contain probably about 7 per cent. moisture and organic matter, about 6 of soil and sand, and 87 per cent. of carbonate of lime. In passing through the kiln the carbonic acid is mostly expelled. If completely expelled the loss would be 38 pounds of carbonic acid for 100 pounds of shells, leaving 49 pounds of quick lime (calcium oxide). With this would of course remain the sand, mud, etc., that originally adhered to the shells, together with the ashes of the coal used in burning.

The lime thus obtained is slacked by throwing on water, in order to reduce it to a powder. In this process of slacking, water and lime enter into chemical combination, the 49 parts of lime becoming 64 parts of hydrate of lime. In practice some carbonate of lime remains undecomposed by the burning, and in the

unscreened oyster-shell lime described on a previous page, whose average is 59 per cent. As 1,000 pounds of the latter costs at New Haven, shipped in casks, $3.20, it is evident that the proposed price of the marl, $15 per ton, is much too large, even after making the most liberal allowance for cost of handling.

MARINE MUD AND SEA WEED.

A sample of black mud containing some seaweed from salt water at Saybrook, was sent to the Station by Geo. M. Denison, Esq., who states that it is exposed at low tide, and can be got upon the land for about 25 cents per load.

	327
Water	71.32
*Organic and Volatile matters	2.79
Sand, Clay and substances insoluble in acid	20.82
†Oxide of Iron and Alumina	2.82
Lime	.26
Magnesia	.51
Soda	.00
Potash	.17
Chlorine	.51
Sulphuric Acid	.39
Phosphoric Acid	trace.

*Contains Nitrogen, 0.14 per cent.
†Most of the Iron exists as protoxide.

This mud contains, in fertilizing elements, the small amount of *nitrogen, lime, magnesia, soda, potash, chlorine,* and *sulphuric acid,* given in the analysis, altogether amounting to about 2½ per cent of the total. But stable manure—the standard fertilizer—contains but about the same amount of plant-food, and of the same kinds, except that it has less sulphuric and more phosphoric acid, less soda and more potash.

The mud, when used judiciously, will prove an excellent fertilizer. Doubtless other samples might contain more phosphates. In any case, the mud, used copiously, together with fish, which are rich in nitrogen and phosphates, and with seaweed, which contains abundant potash, will supply all the plant-food that crops require, and serve to maintain or increase fertility of the soil to the fullest degree.

cost about 1½ cents more per bushel and the casks cost $1.00 each, which would bring the cost of a ton up to about $6.40, two casks included.

The screenings, **330**, consist largely of imperfectly burned lime, entire or in fragments. They are not shipped but are sold at the kilns for 4 to 6 cents per bushel.

The unslacked lime, of which we have no analysis, is stated to weigh on the average 70 pounds per bushel, and is sold in bulk at the R. R. Depot, for 17 cents per bushel or about 24 cents per 100 pounds, or $4.80 per ton. Shipped in casks, its price is 19 cents per bushel, the casks costing $1.00 each, which would make the ton cost $7.70.

Analyses of Oyster Shell Lime and Screenings.

	328	329	330
Lime	64.47	53.60	53.82
Magnesia	.41	.32	.24
Oxide Iron and Alu'na	1.50	1.43	1.14
Soda	.16	.27	.15
Potash	.04	.06	.03
Carbonic acid	7.79	8.89	22.34
Sulphuric acid	.52	.69	.23
Chlorine	.04	.02	.01
Phosphoric acid	.17	.13	.15
Silica	2.24	2.41	6.12
Sand	3.08	2.85	
Coal	.65	.94	2.60
Water (by difference)	16.93	28.39	13.17
	100.00	100.00	100.00

In the subjoined statement are given the proportions of the various chemical compounds that probably exist in the samples.

	328	329	330
Carbonate of lime	17.45	19.73	50.52
Hydrate of lime	68.64	52.94	32.29
Sulphate of lime	1.12	1.48	.49
Phosphate of lime	.37	.41	.33
Silicate of lime*	4.33	4.66	—
Magnesia	.41	.32	.24
Carbonate of potash	.06	.09	.04
Carbonate of soda	.22	.43	.24
Sodium chloride (com. salt)	.07	.03	.02
Oxide of Iron and alu'na	1.50	1.43	1.14
Silica	—	—	6.12
Sand	5.08	2.85	
Coal	.65	.94	2.60
Water	.00	15.39	4.07
	100.00	100.00	100.00

On referring to the results of these analyses we notice that the two

slacking process, the use of insufficient water may leave some quick lime unconverted into hydrate, or excess of water may remain as moisture, as is the case with sample **329**.

When applied to land, oyster-shell lime may act as a *fertilizer* strictly speaking, or as an *amendment*. Commonly, both kinds of action are exerted, and the distinction between fertilizer and amendment is not generally recognized in practice although very important in considering the effects of this substance. Lime is used as an amendment on heavy clay soils, 2 to 3 or more tons being sometimes applied per acre. On loams or light lands 1,000 pounds or 20 bushels of oyster shell lime, applied once in two or three years, is a usual application, equivalent to the addition of 300 to 500 pounds to the acre, annually. It is evident that the small quantities of potash, magnesia and phosphoric acid contained in such doses of oyster shell lime can have no sensible effect upon crops. It is the lime, alone therefore, to which any benefit must be ascribed. A consideration of the modes of action of hydrate of lime, when applied as a fertilizer, will make evident that it is one of the most valuable aids to the farmer and deserves more attention from Connecticut land owners than it has received.

Our cultivated crops contain on the average as much lime as potash. The necessity for the application of potash salts is fully recognized, but probably the lack of lime is as common a cause of unfruitfulness; for while potash seldom wastes from the soil to any serious extent, and is found in spring, well, and river waters in extremely small quantities, lime freely dissolves in water and rapidly wastes from the soil, so that other things being equal there is more need for its restoration.