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## Cement Materials in Iowa

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## CEMENT MATERIALS IN IOWA.

BY E. H. LONSDALE.

[Abstract.]

Some time after the discovery of massive deposits of the Cretaceous chalk in the northwestern portion of the state the question arose as to the adaptability thereof-- whether this calcareous material might be considered of any practical value and if so what means should be taken to reduce it preparatory to its application. Certain initiatory steps were undertaken towards determining these points but as yet but little has been done. Chemical analyses have been made of the rock and test shafts put down in order to ascertain the thickness of the beds, but further development has never been attempted.

Vicat and Pasley were among the investigators who sought to determine some means through which the manufacture of artificial cement might be made possible and they soon proved that a mixture of chalk with clay or river mud produced the desired results. Since that time the growth of the industry has been rapid in this as well as foreign countries.

The well known Portland cement now so extensively produced and generally utilized is made by the calcination of a mixture of chalk with argillaceous material. It sets more readily and its adhesive powers are claimed to be stronger than in the case of the natural cement. The relative amounts of the two components vary at different plants. In the United States and in France and England what is known as the wet process is used, while in Germany the dry method is adhered to. The affinity which caustic lime has for silica and alumina and the affinity of the combination for water gives rise to the hardening of the materials. The degree to which the calcining should be carried on depends upon the percentage of the alkaline silicates in the calcareous body, and since these are shown by analyses to be practically absent from the Iowa chalk, a high calcination

is desirable. The relative amounts of the chalk and clay in the same locality vary greatly, owing to the differences in the chemical composition of the material making up the several strata. The common ratio of chalk to clay is about three to one. A test of certain clays about Sioux City shows that a proper proportion could only be obtained through the mixing of five parts of one kind of clay or two parts of another with but a single part of the chalk.

These chalks, which have been fully described by Calvin in various articles recently issued, are available in the northwestern portion of Woodbury county and in the southwestern part of Plymouth along the bluffs of the Big Sioux river. The maximum thickness of the chalk is about fifty feet and the areal extent is so great as to make it wholly inexhaustible. In speaking of these chalks and clays Calvin\* makes a brief reference to the adaptability of the materials for Portland cement and there certainly seems no reason why the Iowa material might not be used with success equal to that attained at other points. The most natural combination would be the chalk with the clay immediately under it.

Away from the Sioux City region there are no other chalk beds east of the river until a point in the extreme southeastern township of Sac county, nearly east of Grant City, is reached. An exposure several feet thick of very clean, yellow to white chalk has been discovered here. It is not very unlike that to the west. The associated clays are neither so readily available nor so adaptable to use in cement making. It may be that further search will reveal splendid grades of argillaceous materials at this point, and if so the manufacture of cement may be carried on here fully as successfully as at the localities already mentioned. On account of its softness the chalk is far preferable to the hydraulic limestone and the resulting cement is equally strong.

Selenitic or gypseous cement is secured by substituting gypsum for the chalk in combinations much the same as those referred to; and, although no attempt has been made to utilize the massive mineral at Fort Dodge in the manufacture of cement, it would seem that it could be readily done. The available clays in this vicinity are not like those associated with the chalks, but the superior grades, such as are now being used for common pottery, are found near by. The hardening of the

\* Iowa Geol. Sur. Vol. I, First Ann. Rep., pp. 158 and 160, 1893.

gypseous cements takes place principally through a combination with water rather than in the manner of ordinary hydraulic cement, where the hardening is brought about by re-crystallization of the calcium, alumina and silica present.

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## MISSISSIPPIAN ROCKS OF CENTRAL IOWA\*.

BY H. FOSTER BAIN.

The Mississippian series includes all the rocks lying between the base of the coal measures and the top of the Devonian. They have been principally studied in southeastern Iowa and adjacent portions of neighboring states. More recently the study of the exposures of that portion of central Iowa which includes Marion, Mahaska, Keokuk and Washington counties has allowed the construction of a central Iowa section.

As shown in this region the rocks include the following divisions:

Saint Louis	}	Pella beds.
		Verdi beds.
		Springvale beds.
Augusta.		
Kinderhook	}	Wassonville limestone.
		English river gritstone.
		Maple mill shale.

These beds are separated on lithologic and stratigraphic grounds. Faunal studies have not yet been carried to any degree of completion, but seem so far to confirm the divisions.

The divisions of this section are readily correlated with those of the southeast. The minor divisions of the Augusta found in the latter region are not traceable farther north.

The Maple mill shale contains certain fossils with Devonian affinities and may be ultimately placed in that series.

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\*Abstract of a paper published in full in *American Geologist*, vol. xv, under the title *Central Iowa Section of the Mississippian Series*.