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# Preliminary Report on the Clay Industry of Nebraska

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# NEBRASKA GEOLOGICAL SURVEY

ERWIN HINCKLEY BARBOUR, State Geologist

VOLUME 4

PART 29

PRELIMINARY REPORT ON THE  
CLAY INDUSTRY OF NEBRASKA

BY

ERWIN H. BARBOUR



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## PRELIMINARY REPORT ON THE CLAY INDUSTRY OF NEBRASKA

BY ERWIN H. BARBOUR

The primary object of this preliminary report, on clays and clay industries of Nebraska, is commercial. At the same time it is, to a certain degree, historical, and serves to show the present status of the industry, and may prove useful in comparing growth and advancement. It is of economic significance in so far as it shows our clay possibilities, thereby helping to develop existing enterprises and to bring clay workers into the State. Every good and progressive citizen attracted to a growing commonwealth is a distinct gain, and every good one diverted is a loss. It is of still greater significance to add industries for they assure permanence of employment, help to develop resources, and to advance the commercial rank of a state.

### IMPORTANCE OF THE CLAY INDUSTRY IN THE UNITED STATES

The wealth derived annually from clay in the United States exceeds the amount derived from the two precious metals, gold and silver, combined. The different outputs are as follows:

Year	Clay	Gold	Silver
1900	\$ 96,212,345	\$78,159,674	\$36,576,900
1902	122,169,531	80,000,000	29,415,000
1905	149,697,188	87,948,237	35,850,955
1907	158,942,369	90,435,700	37,299,700
1909	166,321,213	99,673,400	28,455,200
1910	170,115,974	96,055,200	30,186,801
1911	162,236,181	96,890,000	32,615,700
1912	172,811,275	93,451,500	39,197,500
1914	164,986,983	92,823,500	37,232,948

There have been repeated gold excitements in Nebraska to disturb the peace and quiet of our people. Why do we so insistently magnify the importance of these two precious metals and minimize that of the clay industry wherein lies the possibility of greater wealth? To "get rich quick" may be the underlying psychology. The mining of gold and silver has the fascination of the lottery and the lure of gambling.

Notwithstanding the fact that natural fuels are apparently wanting in Nebraska, as evidenced by deep wells throughout the State, our clay workers are successful and prosperous, showing their achievements to be a question of good business management rather than one of fuel. It does not necessarily follow that because one is engaged in practical affairs he is therefore a good business man. To the contrary, many so engaged are poor business men. Their mediocre success, or their positive failure, often forces upon a community the unfortunate conviction that the industry is at fault, instead of the man in charge. By force of circumstances over which they have no control, some excellent men do not measure up to their real ability. A gold mine itself may be a failure in the hands of one man, a success in those of another. So it is with a brick plant. In the main, our clay workers are plainly successful, and are men of undoubted influence, some even of affluence.

Incident to the normal and wholesome growth of our State comes an increasing demand for better and more lasting building material. The pioneer stage has long been passed, and the very things which were unwarranted luxuries in the days of grasshoppers and sod houses are now necessities. Farmers and villagers alike are replacing old structures with bigger and better ones, and are demanding better brick and mortar and better workmanship than heretofore. The cities and larger towns, touched by civic pride, which happily enough seems contagious, are assuming metropolitan airs to the extent at least of sewerage and paving. All of this creates demand. The State has never met the demand for brick from its own kilns, and consequently is compelled to import building and paving brick from the neighboring states, Illinois, Iowa, Kansas, and Missouri. Our citizens should feel humiliated to walk daily upon brick stamped Coffeyville, Galesburg, and Des Moines, while extensive beds of Nebraska clay, capable of producing brick of equal quality, lie idle and undeveloped.

Our clay beds are numerous, some of them of great thickness and of broad extent. The demand for all clay products is strong and conditions for manufacture favorable. Coal, is readily procured from Iowa, Illinois, Missouri, or Kansas. Cities and towns are using increased amounts of common and ornamental brick, architectural

terra cotta, sewer pipe, tile for roofing, and the like. Many cities are paving streets with vitrified brick and the time is ripe for a similar treatment of many country roads. The very clays for these specific purposes are awaiting development in this State.

It is argued that we lack artisans trained in refined and technical methods necessary for the production of choice clay ware, but this is remediable. It is also charged that so much experimentation is necessary that profits will be greatly reduced. This points unmistakably to the necessity of establishing clay schools in our State University, similar to those in Ohio, Illinois, New York, and elsewhere. Individual experimentation is generally wasteful. Such work should always be conducted by a few men in experimental laboratories for the benefit of the masses of clay workers, just as thousands of experiments are tried by a few in the laboratories of our state agricultural experiment stations for the masses of agriculturists. As agriculture has been immeasurably benefited by the establishment, in every state, of agricultural schools and experiment stations maintained by state and federal aid, so surely can mining interests be benefited by a similar establishment of mining schools and experiment stations supported in a like manner by state and federal appropriations. In the University of Ohio, for instance, any clay worker, feeling the need of special technical training, can register in the clay school and can pursue a special vocational course fitting him for his work, just as an agriculturist, feeling the need of special technical training in some branch of farming or dairying, can register and pursue his vocational course. The time is close at hand when clay workers, miners, and quarrymen in every state can enjoy a like privilege and advantage, for the establishment of state mining schools and experiment stations must soon be a reality. Bills for the establishment of such schools, introduced in Congress, are plainly received with growing favor by our legislative representatives in Washington. They mean for the country a great economic and industrial gain, and cannot fail eventually to materialize. Such state mining schools afford instructional facilities for all branches of practical mining, including clay work, thereby tending to unify and stimulate the industries. These become stations to which samples of clay, brick, stone, cement, and so forth, can be sent for all sorts of



chemical and physical tests. Years of patient experimentation are necessary to develop all the possibilities of Nebraska clays.

In the early days of agricultural schools and agricultural experiment stations, the objection was raised that farming was to be learned on the farm and not in schools and from books, but it quickly developed that such sayings and beliefs were fallacious. It further developed that farmers, recognizing the importance of such training, sent their sons and daughters to the agricultural schools and attended certain courses themselves wherever possible. So it will be with clay schools, where it must quickly develop that study of theory and laboratory practice are invaluable aids to practical clay work. There is a tendency on the part of those who have not had technical training to speak of the merits of practice and the demerits of theory. They group the great army of self-styled "practical fellows" in one class and the theorists in another, forgetting that the two have a common purpose. If one is looking for the truth in this connection, he will find that theory and practice supplement each other. False pride should not keep the practical man from accepting of the theorist any hints which may aid his work, and *visa versa*.

#### HISTORICAL

Since 1891 the writer has been studying the clay and quarry interests of the State whenever the exactions of the laboratory and class room would allow. The first attempt at a systematic study of our clays and quarries was undertaken in the summer of 1895 when the writer sent Mr. C. A. Fisher, University of Nebraska 1898, and Mr. W. H. H. Moore, University of Nebraska 1900, into the field with team, wagon, and camp outfit to visit each and every clay pit and quarry in southeastern Nebraska.

Mr. W. H. H. Moore continued this investigation during the summer of 1900, and Mr. E. G. Woodruff, University of Nebraska 1901, made a special study of Cass County 1901 to 1903. All field parties, wherever sent and whatever the nature of their work, made observations on quarries and clay pits in the regions assigned to them. But a special effort has been made during the last few years to get careful data respecting the industry throughout the State. In

1911 and 1912 the writer detailed Mr. J. B. Burnett, University of Nebraska 1915, and Mr. Herbert Grumann, University of Nebraska 1915, to the special work of visiting each and every exposure, clay pit, and brick kiln in Nebraska. At the same time the writer, Professor Schramm, and others of the Survey staff aided in bringing to date facts bearing on the status of our clay industry. While this first report is necessarily incomplete it nevertheless serves as a basis for future reports. It is difficult, if not impossible, to bring such reports to date.

A technical study of our clays has been undertaken by Professor Borrowman for his doctorate, and the results of his investigation will be published as a separate volume by the Nebraska Geological Survey. This work comprises complete chemical and physical analyses of our clays. This is the first exact work done upon Nebraska clays and the results when published cannot fail to be acceptable, timely, and valuable.

The briquettes were burned under varying conditions with resultant differences in color and texture. The entire set will be properly displayed later in the cases of the State Museum, for the instruction of brick workers in general.

The adaptability of Nebraska clays to the more artistic uses, such as terra cotta, tiles, vases, and the like, has had due consideration. This work was done, in cooperation with Professor Borrowman, by Miss Anna L. Hinterlong, University of Nebraska while a fellow and assistant in the Department of Geology. Some interesting and instructive results were obtained which will be embodied in a joint report by the two collaborators. This too is an original investigation, for hitherto no attempt has been made to study the adaptability of our clays to art wares. This set, now on exhibition in the Nebraska State Museum, comprises numerous vases unglazed and glazed, tiles, and plaques.

Some 25 years ago, J. Sterling Morton had some elaborate panels of terra cotta made from Nebraska City clays.

#### WHAT IS CLAY

Clay, the most abundant and widely distributed of all mineral substances, consists, as ordinarily stated, of hydrated silicate of alumina. It is mixed however in nearly all cases with various im-

purities, chiefly silica, lime, and iron. It is practically universal in distribution therefore familiar to everyone, and definitions are superfluous. However, we must so broaden our conception of common plastic clay as to include many earthy, un-clay-like substances. If they are more or less plastic and harden when burned, they may be classed as clays, although containing but a small percentage of clay.

#### THE ORIGIN OF CLAYS

All clays result from the decomposition of some kind of rock, feldspathic rocks, meaning those rich in feldspar, being especially productive. The feldspars, which are counted the most important of all rock-forming minerals, are rich in clay, and since igneous rocks are full of feldspar, it follows that they become the great clay producers when subjected to the destructive processes of weathering. Under weathering processes, a full discussion of which may be found in any physical geography or geology, is included such natural rock-destroying agencies as sunlight, heat, cold, dew, chemical action, wind and rain, expanding roots, and burrowing animals.

The best known clay-producing igneous rocks are granite, syenite, diorite, rhyolite, and the porphyries. Great beds of such rock are often decomposed, for considerable depths, into high-grade clay termed residual, because it occurs as a residue where formed. This term is in contra-distinction to transported clays, meaning those which have been carried from their native places by wind, water, or ice. Residual clays, like residual soils, abound below the glacial limits in the southeastern half of the United States, while transported clays, like transported soils, abound in the north, that is, in the region of glaciation.

All clays, including shale and slate, were derived either directly or indirectly from igneous rocks. It may be cited that decomposed lime rock and sand rock, which are sedimentary instead of igneous, yield clay beds also, but this is because these rocks contain a certain amount of clay as impurity, which came originally from igneous rocks.



A CLASSIFICATION OF CLAY

- |  |   |  |             |  |
|--|---|--|-------------|--|
| Residual clays.<br>Formed in place.                            | } | 1. Kaolinite, theoretically pure clay, rare, and of little commercial importance. This is often spoken of as clay body, clay base, or clay substance. Not found in Nebraska. |             |  |
|  |   | 2. Kaolin is kaolinite mixed with impurities. The purest commercial clay. Used for china ware, fine porcelain, body for paper, etc. None save low grades found in Nebraska.  |             |  |
| Transported clays.<br>Carried by water, wind, ice, or gravity. | } | 1. Water borne   | Marine      | { Shales { Kaolins<br>Fire clay<br>Common clay             |
|  |   |  | Fresh water | { Lake shales<br>Common clay<br>Limy clay<br>Alluvial clay |
|  |   | 2. Glacier borne   |             | { Boulder clay<br>Glacio-fluvial clay                      |
|  |   | 3. Mostly wind-borne   |             | Loess  |
|  |   | 4. Gravity borne   |             | { Colluvial clay<br>"Landslide" clay                       |

Colluvial clay, like colluvial soil, is generally formed on slopes, from the decay of native material, but, owing to gravity, aided by water, it creeps and accumulates on lower levels, hence strictly speaking it can scarcely be called transported, and since it has slipped from its original bed it is scarcely residual, justifying the name colluvial.

CLASSIFICATION OF NEBRASKA CLAYS

- |             |   |   |
|-------------|---|---|
| Residual    | { | None. No igneous rocks  |
|             |   | Kaolin, impure, if at all. Louisville, Tekamah  |
|             |   | Marine shales, and indurated clays of the Carboniferous of southeastern Nebraska  |
|             |   | Fire clay. Carboniferous, Dakota  |
|             |   | Fluvio-marine, Dakota clays   |
|             |   | Marine, Graneros, dark and carbonaceous   |
|             |   | Carlisle shale, dark and carbonaceous   |
| Transported | { | Pierre shale, drab shales, marine, productive of gumbo flats  |
|             |   | Lacustrine and fluvio-lacustrine of the Oligocene and Miocene bad lands, mostly yellow and arenaceous   |
|             |   | Glacial, abundant over the eastern fifth of the State, much of it often mistaken for loess  |
|             |   | Alluvial, gumbo flats in low places, clay beds along streams  |
|             |   | Æolian, loess covering the southeastern half of the State, really sand and silt with a little clay, most extensively worked beds in the State |

## GEOLOGY OF NEBRASKA CLAYS

After the manner of history, geologic history is divided roughly into ancient, middle, and modern. The deeper and older crust, whether visible or concealed, consists of crystalline rock such as granite, syenite, diorite, gabbro, and peridotite, which contain as accessories or as essentials a number of minerals, the more important of which are quartz, orthoclase, labradorite, albite, anorthite, sodalite, lucite, muscovite mica, biotite mica, hornblende, pyroxene, augite, olivine, chlorite, serpentine, iron oxide, magnetite, apatite, zircon, garnet, pyrite, tourmaline, topaz, and so forth. Some of these decompose more quickly than others, and naturally when feldspar weathers into kaolin, it is quite likely to include minute crystallites and particles of the above mentioned group, more or less altered by decomposition.

In Nebraska there are none of the most ancient rocks, while the sediments of middle and later geologic times are well represented. Sedimentary deposits are often of great thickness, such for instance as those of the Appalachian range, which exceeds 10 miles in places, hence certain clay beds, toward the base of the series, are subjected to enormous pressure and accordingly are hardened or indurated, compacted into shale, or, under the right conditions, converted even into slate. All of these, including the finest roofing slate, which is compact, hard, and possibly partially crystallized, are easily reduced to clay again by sufficient exposure to the weather. Some of our Nebraska clays and shales of the Carboniferous formation are hard and compact and must be crushed and ground before mixing. Some are exposed to freezing and thawing during winter and are then worked the following spring and summer.

Clays may be relatively free from sand, or there may be every gradation of admixture. It is a common experience to find beds of clay merging insensibly into sand and back again into clay, and no one can put his finger on the spot where it ceases to be clay and becomes sand.

During the process of firing, all clays shrink to a certain extent, chiefly because of the water driven off, and also on account of the increased density. Lean clays shrink least, fat clays most, hence it is an old rule to mix the fat and the lean. A fat clay, an old but excellent name, is smooth, plastic, soapy, even unctuous to the touch and may shrink or warp badly, the shrinkage often equalling one-

third of its volume. A lean clay is not thoroughly plastic, is not smooth and soapy to the touch because it contains a high percentage of silica, chiefly in the form of fine sand, and bears high temperatures in firing without much shrinkage or warping.

#### CLAYS OF THE CARBONIFEROUS OR PENNSYLVANIAN FORMATION

The Carboniferous formation outcrops in the very southeastern corner of Nebraska wherever the surface materials are washed away. Carboniferous exposures may be found in the following counties: Richardson, Nemaha, Cass, Sarpy, Douglas, Washington, Johnson, Pawnee, Gage, Lancaster, and Saunders. A simplified geologic map will be found in this Volume, part 7, plate 19, and a section across the State showing superficial beds will be found in this Volume, part 25, page 341. This formation abounds in shales and clays upon which are based some of the most important clay industries in the State, such as those at Table Rock, Humboldt, Louisville, and Avery. There is such a mantle of glacial drift and loess covering our Carboniferous rock that its outcrop is confined mostly to narrow valleys, and to bluffs facing the bolder water courses. These beds dip slightly to the west and disappear in the region of Lincoln, not reappearing until the Rocky Mountains are reached. The total thickness of the Carboniferous is about 1200 feet. In addition to the clay industries already established on our Carboniferous clays, there are fine opportunities for the establishment of new plants at Blue Springs, Wymore,<sup>1</sup> Salem, Nehawka, and intermediate points.<sup>2</sup> The possibilities at Table Rock are worthy of the attention of manufacturers. Here two great clay pits have been stripped and opened, two large plants established, and machinery installed. Owing to a complication of causes, these are now idle. Opportunity awaits clay workers at Table Rock. A company, under the name of The Table Rock Brick Plant, has recently been organized by Vice-president F. A. Stech of the Community State Bank of that place. The original Table Rock brick plant has been purchased and will again be in operation sometime during the summer of 1917.

<sup>1</sup> Barbour, Erwin H. An Important Undeveloped Clay Bed, Neb. Geol. Survey, Vol. 4, Pt. 6, Bull. 28.

<sup>2</sup> Gould, C. N., and Fisher, C. A. The Dakota and Carboniferous Clays of Nebraska, Annual Report, Nebr. State Bd. Agriculture, 1900, pp. 185-194.



## CLAYS OF THE DAKOTA FORMATION

The Dakota formation is popularly spoken of as the Dakota sand because of certain characteristic, well-known, yellowish-brown friable sandstones found in it. However, the clays of this formation are perhaps as abundant as the sand, though less easily recognized, and less well-known. The formation varies from about 300 to 400 feet in thickness, and the exposure runs as a broad band in a north-easterly direction across the State, from Gage County to Dakota County. The Dakota formation, like most of the other formations of the State, is heavily mantled with soil, and it outcrops, occasionally, in the following counties: Jefferson, Gage, Lancaster, Cass, Saunders, Sarpy, Douglas, Dodge, Washington, Burt, Thurston, and Dakota.

The Yankee Hill Brick Company, near Lincoln, works Dakota clay, while the Klose Brothers of Lincoln work loess, adding a little Dakota clay, shipped from the Klose pit several miles south of Lincoln. Dakota clays are mostly light in color, and yield brick of fine quality and of a wide range of texture and color.

At Steel City considerable amounts of Dakota clay are mined and shipped to Hastings, for use in tempering the loess clays of that place.

## CLAYS OF THE GRANEROS

The Graneros, Cretaceous in age, is a narrow strip of dark shale of marine origin, 20 to 30 feet in thickness, as shown by scattered exposures found in Thayer, Jefferson, Saline, Seward, Saunders, Dodge, Burt, Thurston, and Dixon counties. This bed thickens to the westward, and reaches a reported thickness of 600 to 800 feet in the Black Hills. In certain regions, this formation may be recognized with great ease because it lies directly under the pale-buff shell-layer, known as the "oyster beds" or the Greenhorn limestone. The dark shale occurring above the shell-layer is Carlile shale. Carlile shale is utilized in the manufacture of cement at Superior. As far as our records show, there are no clay plants in the State making use of the Graneros shales.

## GREENHORN LIMESTONE

The Greenhorn limestone runs as a narrow band following the Graneros and lying directly between the Graneros on the east and

the Carlile shale on the west. This limestone has a thickness of about 20 feet, and its chalky whiteness and its abundance of shells, *Inoceramus*, make it readily distinguishable. Because of the close resemblance of these shells to oyster shells, the beds in which they are found are called the "oyster beds," the best-known exposure being back of the Soldiers' Home at Milford. Other well-known outcrops are at Hebron, Fairbury, Wynot, and elsewhere. The "oyster beds" are so strikingly characteristic that they are generally observed and known. Then too, the whiteness of this layer is in bold contrast to the blackish layer, the Graneros, under it, and to the dark drab layer, Carlile shale, above it. It is a key bed which our clay workers, though not professional geologists, can recognize and use to advantage.

#### CLAYS OF THE CARLILE FORMATION

Carlile shale, found in the Republican Valley, extends from Nuckolls County northward to Dixon, and consists of marine shales about 400 feet thick. It lies between 2 white layers, the Greenhorn at the bottom and the Niobrara chalk at the top. The utilization of Carlile shales in the manufacture of brick is under contemplation. At Superior, the Nebraska Portland Cement Company<sup>1</sup> is using the chalk and Carlile shale in the manufacture of Portland cement, for which purpose, according to all physical and chemical tests, they seem admirably adapted.

#### THE NIOBRARA CHALK

The Niobrara formation is recognized everywhere as chalk. This extends as a broad white band west of, and parallel to, the above described formation. It is of marine origin, and outcrops in the following counties: Franklin, Webster, Knox, Boyd, and sparingly at intermediate points.

While chalk bears no relation to the clay industry, the Niobrara formation must be mentioned because it is so readily distinguished and serves as a key to the formation below it, which is Carlile, and to that above, which is Pierre.

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<sup>1</sup>Barbour, Erwin H. Cement Manufacture in Nebraska, Neb. Geol. Survey, Vol. 4, Pt. 7, Bull. 29.

## CLAYS OF THE PIERRE FORMATION

Our Pierre shale, though mostly concealed by overlying beds, covers the balance of the State, and increases in thickness to the westward until the Denver basin is reached, where it is reported to be 7,000 feet in thickness. It must be understood that in most places the Pierre shale is covered by sandhills, loess, and Tertiary deposits. It is found in the western part of the Republican Valley, along the Niobrara and Missouri rivers, and in the northwestern corner of Nebraska in the region of the Bad Lands. This shale is of marine origin, and in certain places abounds in shells such as ammonites, and baculites, ordinarily called "fishes." We know of no clay industry based upon this formation, although there is prospect of the establishment of one or more brick plants to work Pierre shale.

## THE BAD LAND FORMATION

The position of the Bad Lands in western and northwestern Nebraska, is so generally known that description is unnecessary. The older Bad Lands contain considerable beds of clay which could be worked. However, most of these occur in rather remote and sparsely settled places. All of the Tertiary beds in Nebraska are of fresh water origin, and the total thickness is about 1300 to 1800 feet. The later Tertiaries tend to sandiness.

## GLACIAL CLAYS

Glacial deposit covers the eastern fifth of the State, the exact western limit being in some doubt. This consists of clays, sands, gravels, and boulders, more or less intimately mixed. Glacial clays often resemble the loess to such an extent that confusion has prevailed respecting the thickness of the drift in Nebraska.<sup>1</sup> There are broad expanses of drift which have been hitherto mapped as loess. All of southeastern Nebraska is covered with a heavy mantle of drift, heretofore called loess. In a like manner there are great patches of glacial drift without a loess cap in the northeastern part of the State and at intermediate points. Drift clays are apt to be more heterogeneous in character and less uniform than other clays and shales. A few brick kilns are working glacial clays.

<sup>1</sup>Barbour, Erwin H. A Minor Phenomenon of the Glacial Drift in Nebraska, Vol. 4, Pt. 9, Bull. 31.



## NEBRASKA LOESS CLAY

Loess, or bluff deposit, covers most of the southeastern half of the State, and is universally known as the buff-colored soil of great thickness which tends to weather into vertical walls. Analyses of numerous loess samples show an average of but 10 to 12 per cent of clay, nevertheless, more brick kilns in Nebraska are based upon this clay than upon all others combined.

An average loess soil based on 85 analyses is as follows:

	Per cent
Organic matter 4.0, moisture 3:5.....	7.5
Medium and coarse sand and gravel.....	3.5
Fine sand .....	7.5
Very fine sand .....	36.0
Very fine silt 4.0, and silt 27.0.....	31.0
Clay .....	14.5

In origin, loess is counted by most authors as a wind-borne deposit, yet the final word remains to be said upon this subject. Though not a clay in the ordinary acceptance of the term, it acts much like clay, hardens on burning and is classed as a clay.

In the following table are listed analyses of loess clay from various counties in Nebraska. The analyses are by Professor Whitney.

Number of analysis.	LOCALITY.		Moisture in air-dry sample		Organic matter.	Gravel	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt	Fine silt.	Clay.								
	COUNTY.	TOWN.	Pct.	Pct.										2-1 mm.	1-5 mm.	.5-25 mm.	.25-1 mm.	.1-.05 mm.	.05-.01 mm.	.01-.005 mm.	.005-.0001 mm.
														Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
418	Adams	Hastings	3.24	5.98	0.00	0.00	0.03	0.11	10.43	55.14	7.50	16.45									
1440	Adams	Hastings	5.71	4.31	0.00	0.00	0.02	0.32	27.79	42.89	1.09	17.67									
1843	Antelope		4.33	6.73	0.00	0.00	0.05	1.28	46.19	25.06	4.38	12.42									
2085	Blaine	Dunning	0.46	0.76	0.00	0.12	3.28	70.05	22.29	1.14	0.23	2.12									
2105	Boone	Cedar Rapids	2.81	3.20	0.00	0.00	0.26	2.27	58.07	11.26	2.37	20.83									
2079	Box Butte	Alliance	2.91	4.64	0.17	0.28	1.77	5.15	43.48	20.54	1.73	20.63									
2117	Buffalo	Ravenna	2.55	2.90	0.00	0.07	0.40	4.22	49.01	27.93	1.53	11.43									
2113	Butler	Milberton	4.17	4.82	0.00	0.00	0.04	0.19	36.37	23.47	4.70	26.70									
1812	Cass		4.90	5.30	0.00	0.00	0.00	1.10	12.07	54.25	9.00	12.35									
2073	Cass	Weeping Water	4.17	5.80	0.00	0.05	0.07	0.20	24.35	39.47	3.58	23.82									
1492	Cedar	Hartington	2.72	3.31	4.39	8.69	15.88	11.48	13.23	32.47	3.29	4.70									
686	Cheyenne		0.41	0.66	0.00	0.16	14.48	64.61	17.49	0.09	0.28	1.12									
2089	Custer	Merna	2.80	2.82	0.00	0.00	0.02	3.97	57.49	15.73	1.45	14.40									
2077	Dawes	Crawford	1.59	2.70	0.07	0.32	1.22	12.65	71.31	3.57	0.64	6.40									
682	Deuel		0.26	1.13	0.00	0.00	19.70	69.00	6.95	0.31	0.51	2.35									
1797	Deuel	Chappel	1.93	3.43	0.04	0.05	1.26	15.83	55.97	10.72	3.31	7.17									
1916	Douglas	Seymour Park	2.59	7.54	0.00	0.00	0.00	0.00	0.00	61.36	5.61	24.37									
393	Dundy	Benkelman	0.70	6.10	0.00	0.00	1.45	4.90	62.00	8.89	2.32	17.75									
1467	Fillmore	Fairmont	6.21	4.97	0.00	0.00	0.05	0.40	20.84	46.12	1.21	21.34									
1865	Fillmore	Geneva	4.63	2.39	0.00	0.00	0.00	0.56	23.87	40.51	5.55	22.35									
1820	Gage	Beatrice	5.96	6.40	0.00	0.00	0.00	2.30	12.91	43.47	12.16	17.15									
2083	Garfield	Burwell	1.92	2.02	0.58	0.62	2.36	16.75	55.47	5.90	0.87	14.43									
1490	Gosper		3.60	3.20	0.00	0.00	0.00	0.92	19.37	62.31	3.21	10.00									
2107	Greeley	Troy	2.16	2.28	0.00	0.00	0.24	1.81	73.91	6.65	1.57	12.28									
2111	Hall	Abbott	0.63	1.14	0.15	1.28	12.89	52.24	23.26	3.39	0.41	5.28									
2093	Hamilton	Aurora	4.19	4.26	0.00	0.00	0.02	0.13	35.26	28.05	5.94	23.15									
1838	Harlan	Alma	2.50	2.82	0.00	0.00	0.00	0.00	44.52	33.56	3.41	11.62									
1841	Harlan	Republican City	5.13	5.22	0.08	0.30	0.15	.70	29.95	36.58	6.51	15.40									
391	Hitchcock	Culbertson	1.46	5.88	0.00	0.00	0.00	0.17	48.87	19.01	5.09	19.05									
2101	Hooker	Mullen	0.61	1.05	0.00	0.41	8.59	45.62	39.56	5.86	0.28	3.35									
2081	Howard	St. Paul	0.92	1.68	1.21	3.34	18.49	39.45	23.29	5.76	0.72	5.65									
1828	Jefferson	Fairbury	6.06	6.10	0.00	0.00	0.00	3.16	16.46	41.73	9.48	16.77									
1798	Keith	Ogallala	1.63	2.63	0.02	0.03	0.10	6.11	78.26	5.77	1.69	4.05									
1804	Keith	Ogallala	2.00	2.18	0.00	0.00	0.00	2.25	68.80	19.27	1.70	3.45									
1840	Kearney	Minden	4.38	5.31	0.03	0.00	0.26	0.87	37.93	25.98	7.66	19.05									
3242	Lancaster	Lincoln	5.95	6.37	0.00	0.02	0.11	0.43	23.60	34.22	7.10	24.05									
3243	Lancaster	Lincoln	8.09	4.30	0.00	0.02	0.09	0.37	17.73	30.16	8.13	32.82									
422	Lincoln	North Platte	0.11	4.06	0.08	0.13	0.88	6.04	66.64	8.93	2.60	9.90									
2103	Loup	Taylor	2.46	2.38	0.04	0.15	2.00	8.36	63.45	7.37	1.63	13.70									
1814	Madison		4.90	3.80	0.00	0.00	0.00	0.36	10.47	49.52	9.88	20.60									
2109	Merrick	Palmer	1.84	1.70	0.00	0.19	3.94	33.26	39.26	6.11	1.36	12.33									
2097	Nance	Belgrade	3.04	3.19	0.00	0.00	0.06	0.90	55.96	19.56	2.43	16.10									
1714	Nemaha		4.38	4.72	0.00	0.00	0.00	0.12	28.76	49.30	2.33	10.30									
1715	Nemaha		3.82	4.54	0.00	0.00	0.00	0.10	25.83	54.47	2.53	9.49									
353	Otoe	Nebraska City	6.62	4.53	0.00	0.00	0.28	0.90	15.23	42.15	7.52	21.93									
349	Otoe	Nebraska City	7.92	5.11	0.00	0.00	0.04	0.18	16.10	38.40	9.48	22.17									
2071	Otoe	Syracuse	5.52	4.86	0.01	0.01	0.11	0.52	19.87	35.35	4.99	29.73									
1805	Perkins	Venango	1.13	4.62	10.31	6.28	11.28	18.47	36.36	7.73	1.97	1.44									
2091	Perkins	Grant	0.70	0.80	0.00	0.00	5.06	51.18	38.00	0.40	0.12	3.40									
1832	Phelps	Holdrege	4.75	4.75	0.00	0.00	0.00	0.00	41.40	28.00	5.86	14.80									
1819	Polk	Osceola	2.90	7.32	0.00	0.00	0.00	0.00	20.48	48.72	7.47	12.95									
2087	Saline	Crete	4.88	4.68	0.03	0.02	0.06	0.15	26.81	35.50	3.23	26.20									
2075	Saunders	Valparaiso	2.94	4.08	0.27	0.80	4.39	17.37	36.05	13.50	3.33	18.90									
1830	Scott's Bluff		5.00	2.50	0.00	0.00	6.00	12.64	46.02	14.93	5.51	8.60									
2095	Sherman	Litchfield	1.84	2.26	0.00	0.08	1.66	20.89	52.97	6.95	1.36	13.02									
1829	Sioux		4.60	6.80	0.00	0.00	0.00	2.30	59.96	17.84	3.11	6.35									
2099	Thomas	Seneca	1.17	2.04	0.08	1.15	8.20	40.07	39.17	2.98	0.63	5.05									
1471	Thurston	Pender	4.10	6.60	0.00	0.00	1.25	3.22	8.58	46.88	10.32	17.77									
2115	Valley	Ord	2.15	2.57	0.72	1.45	8.20	17.90	40.06	10.49	1.52	15.60									

## ALLUVIAL CLAY

The most recent of our deposits is the alluvium of our valleys. These often contain sufficient amounts of clay tempered with sand to make excellent brick. Such clays are commonly called valley wash, flood plain, or alluvial clays.<sup>1</sup>

## PURITY AND IMPURITY OF CLAYS

Certain acids common in percolating water help to leach out of igneous rocks, first the alkalies, later the irons, and last and least of all aluminum. Accordingly, aluminum is left behind to form the hydrated silicate of alumina called kaolinite, if pure, or kaolin, if less pure, or clay, if quite impure.

Clay, in its extremest purity, is the mineral called kaolinite, which is hydrated aluminum silicate. The rust of the metal aluminum, that is its oxide, is white and this, when silicated and hydrated, constitutes the mineral kaolinite which is commonly counted the base, body, or foundation, of all clay, and in clay parlance, if not in strict technical usage, is appropriately termed clay substance. In this sense alone is kaolinite of importance to the clay craft, for it is rare. Feldspars, if pure, would yield kaolinite when decomposed, but pure feldspars are exceptional, so is kaolinite. When a few impurities are added to kaolinite, chief of which are a little quartz, potash, and slight traces of lime, magnesia, and iron, it becomes kaolin, which is white or light in color, smooth and soapy to the touch, and often has a strong argillaceous odor, especially if moist. Kaolin occurs in extensive workable beds, and is a very choice clay of great commercial consequence. Since the more precious wares, such as fine porcelain are made of it, we shall call it precious clay.

Kaolin contains 5 or 6 per cent of alkali, a little silica, but only traces of lime, iron, magnesia, and so forth. Accordingly, it burns white, and its texture is fine and vitreous. It does not have constant physical and chemical properties like kaolinite, and therefore is not classed as a mineral.

It is paradoxical perhaps, but nevertheless true, that the so-called pure clays generally contain impurities. This is because kaolin, ordinarily counted pure clay, results from the decomposition of rock,

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<sup>1</sup> Fisher, Cassius A., Comparative Value of Bluff and Valley Wash Deposits as Brick Material. Annual Report, Nebr. State Bd. Agr. 1900, pp. 181-184.

some of whose minerals decompose quickly and completely, some slowly and incompletely. Hence scattered minerals are included in the kaolin. Or there may be admixtures of impurities from the outside contributed by running water or wind. It is often necessary to free clays of these impurities by washing and floating.

Just as we have precious, semi-precious, and base metals, precious, semi-precious, and common stones, so we have precious, semi-precious, and base clays. At any rate, it seems as though the distinction precious and semi-precious is warranted and fittingly applied. Certainly the choice clays which yield such remarkable porcelain wares as the Limoge, Royal Doulton, Dresden, Royal Worcester, Bavarian, porcelains of China and Japan, pieces which oftentimes are works of the highest merit and value, which decorate and beautify the home are entitled to the designation precious.

In the precious clays are included first the purer kaolins, second China clay, and third porcelain clay. Amongst the semi-precious clays we include: first, hard fire clay; second, plastic fire clay; and third, potter's clay. The base clays include: first, tile clays; second, brick clays; third, calcareous shale; fourth, argillaceous shale; fifth, ferruginous shale; and sixth, siliceous shale, and so forth.

Residual clay represents the purest and finest clay in nature, but such beds are rare. The bulk of clay taken the world over is transported clay. Kaolin is ordinarily residual in origin, though occasional beds of good kaolin prove to be transported. Fine material like clay and silt floating in water is often assorted with discriminating nicety, and good beds of kaolin may result. The modern potter's craft with its army of skilled artisans and the capital involved, is based upon this choice, white clay.

The occurrence of kaolin is restricted to the regions where certain feldspathic rocks abound, and naturally the industries based upon it are in a like manner restricted to certain favored localities, while the common clays and their industries, are of wide, almost universal, distribution. Clay-producing rocks are apt to vary in purity, hence kaolin varies and passes insensibly into common clay.

As stated before, when a few impurities, inappreciable in amount, are added to the pure mineral kaolinite, the mixture is kaolin, but when many impurities in considerable amounts are added the mixture is common clay. Common clay, ordinarily consists of varying proportions of kaolinite mixed with lime, iron, and magnesia. It is more or

less plastic, often highly so, smooth and soapy to the touch, and burns to the hardness of brick. Clay is in a state of extremely minute division, hence capable of transportation by water for long distances, and subject to its assorting power. In published laboratory experiments, sand one-hundredth of an inch in diameter, which is barely visible to the eye, or say as fine as the point of a cambric needle, settles 1 foot in 10 seconds, while clay requires 5 days to settle a like amount. Hence, clay can be held indefinitely by mechanical suspension in active water, and carried for long distances at sea, 300 or 400 miles being practically its limit. Accordingly, it is apt to be assorted by the water into beds of varying degrees of fineness and purity.

#### TRANSPORTING AGENTS

The agents which transport clay are wind, running water, ice, and so forth. Clay, when dry, breaks readily into fine dust, which is easily picked up and carried long distances by the wind and dropped over the country in beds of greater or less extent. Clays originating thus are called Æolian or wind-borne clays. Such, in part at least, are the famous loess or bluff clays which cover the southeastern half of Nebraska. These, though rich in sand and poor in clay, are worked more extensively than any other beds in the State, and surprisingly good products result. When dry-pressed some admirable brick is produced from unpromising loess beds.

Streams transport and deposit clay or gumbo along certain valleys and all such beds are called valley-wash, or flood-plain, clays, and they are worked to advantage in several places in the State. When streams deposit their load of clay in ponds or in lakes, the deposit is called lake-clay. Some of our greater streams, like the Missouri river are perpetually turbid with clay and silt, derived chiefly from the great Bad Lands region of South Dakota, Nebraska, and Wyoming. Such streams ultimately discharge their load in the ocean, making beds of marine clay which may be of enormous extent and great thickness. To this class belong our great beds of shale in Nebraska, shale being nothing more than hardened clay.

Extensive beds of shale of Carboniferous age occur in the southeastern corner of the State, and important brick industries are based upon them. Beyond this to the westward occur shales of great thickness belonging to the Cretaceous age, and underlying the surface material of the entire State.

Many of our shales are black, that is carbonaceous, because of admixtures of organic matter, chiefly vegetable. Some are sufficiently bituminous to burn when bits are ignited. They are so often confounded with coal that owners of carbonaceous shale beds have applied for the bounty offered by the State for the discovery of workable beds of coal. Some of our shales yield gas copiously under distillation, and have excited unusual public interest and comment, for a hope is entertained that there is a possibility of deriving commercial illuminating gas from our shales. In this connection, it is a question if the cost of distilling the shales and getting the gas would not offset profits.

But wind and water are not the only transporting agencies, for during the glacial age, great tongues of ice, known as glaciers, pushed southward to about latitude 30 or 40, carrying from British Columbia and distributing over the northern United States large masses of glacial clay, often called boulder clay because of the stray boulders found in it.

A study of modern glaciers shows how those of ancient time tore down, leveled, and carried away continental loads of sand and clay. Clays transported glacially are well-named glacial clays, and are to be found as a superficial cap to bed rock in the eastern fifth of this State. With such an origin one naturally expects our glacial clays to be rather heterogeneous and so they are. They are mixed more or less with sand, gravel, and even large glacial boulders, mostly the dense, reddish, pink, and purplish Sioux quartzite, carried by the ice from the great ledges at Sioux Falls, South Dakota, and northward.

Our glacial clays are often confounded with the loess which is a later and overlying deposit. The two are often quite indistinguishable, but in general the loess is a light buff, of very uniform texture, free from coarse pebbles, and with a tendency to break into vertical lines. Our glacial clays, though often of identical color and texture, tend to be darker, do not break in vertical walls, and often contain coarse pebbles and boulders. Perhaps it may be safely stated that our glacial clays are often distinguished from the loess clays because of the reddish-buff color. However, they range from buff to gray and drab, and from brown to blackish. Broad areas of exposed "loessless" glacial clay are found in southeastern and northeastern Nebraska where the geological maps of the State usually show continuous unbroken loess. Glacial clay is used advantageously in manufacturing brick in several parts of the State.



Since iron is practically a universal pigment, clays are sure to contain it in varying proportions. On firing, iron imparts color to brick, and because of its varying per cents, there is a wide range of color, running from light tints to dark shades. A low per cent of iron gives a creamy tint; an increasing per cent gives respectively, buff, pinkish, cherry red, deep blood red, and brownish red colors. Partial or complete vitrification incident to high temperature produces complex silicates and the iron content often colors the product brown, coal brown, or even black. Yellow and ochreous clay, so called because stained by ochre, limonite, is very common. When burned, such clay turns red by virtue of the fact that water is driven off and the yellow ochre thereby converted into red ochre, the result being the universal red brick. No matter whether a clay is pale yellow, blue, drab, brown, or black, if it contains 4 or 5 per cent of iron it turns red when burned.

In this connection, the degree of heat is to be reckoned with as well as the iron, for certain temperatures produce light tints, while the same clay, subjected to higher temperatures yield rich shades of red. A wide range of color is within the control of the skilful worker, who is enabled to cater successfully to the tastes of fastidious architects and exacting builders. Skilled clay workers boast of their ability to produce an incredible diversity of color according to the iron, and other ingredients in the clay, and according to the amount of air admitted to the kiln. The boast is not an idle one, as practice shows.

One of the most imperative rules in making wares of clay, is to have the clay well mixed into a mass as uniform and homogenous as possible. Otherwise the wares are apt to burst spontaneously, by virtue of their own unequal expansion and contraction. Haste to meet demand compels many workers to ignore this principle, the result being many broken brick and tile. Often the mixing is so hastily done that the burned product is lumpy and unsatisfactory in texture. It is very common indeed, to find lime concretions and pebbles in our clays. During the process of firing, these are dehydrated, that is, reduced to quick lime. Later, perhaps after the brick is laid, the enclosed quick lime absorbs moisture, swells, and bursts the brick. Pieces are even exploded from the faces of walls. The making of all kinds of pottery is based, theoretically, upon the chemical changes which take place when clay is burned.

The word pottery may be restricted to the refined products of the potter's craft, or broadened to include everything molded of clay while moist and then hardened by fire. Before a brick is baked, though it be ever so dry and hard pressed, it can readily be reduced to powder, mixed with water, and brought again to its original plastic clay state. Not so after the brick has been burned. This is because of the chemical changes effected by burning. It must be understood, of course, that in the processes of time, brick must return to clay. In this connection, it is timely to mention the lasting quality of well-baked clay, which is counted the most enduring of all substances produced by art.

Well-known varieties of brick may be briefly described as follows:

Common brick, the best known of all, lacking fineness of texture and color, is used for plain walls, chimneys, and the like, where refinement of effect is of secondary importance.

Face brick, front or pressed brick, as the name implies, is suited structurally for the front or "show side" of buildings, because carefully made of select clay, so as to secure good color, texture, and shape. Pressed brick is so painfully exact that effect brick was a natural consequence. Pressed brick, whether dry pressed or repressed, is very dense and strong with true faces and edges.

Enamel brick, being coated with an opaque enamel, white or colored, is well adapted for many inside and outside uses and is easily kept clean.

Glazed brick, differs in that it is covered with a transparent glaze.

Pale brick, is lighter in color than the average, and apt to be soft, porous, and weak.

Salmon brick, having a color which suggests the name, is insufficiently burned and therefore soft and inferior.

Fire brick, as the name implies, withstands high temperatures and is therefore suited to the lining of furnaces, and the like.

Clinker brick, hard burned and generally dark in color, has the appearance of being semi-fused.

Ashlar brick, is chipped to represent rock-faced stone.

Flashed brick, is treated in firing to bring out certain colors and blotches.

Furring brick, is used for furring inside walls, being grooved to hold plaster well.

Roman tile, long, narrow brick, 12x1½x4 inches in size, is still quite popular.

Ornamental brick, has the surface ornamented by figures in relief.

Tapestry brick, recently introduced, has the surface rendered ragged and rough. Some excellent effects are produced by the proper use of this class of brick.

Sewer brick, used for lining sewers, is burned hard, and is as dense and non-absorbent as possible.

Architectural terra-cotta, is increasing in favor each year. It may be plain or in relief, rough or enameled.

Hollow brick, for structural purposes and fire proofing is increasing in demand.

Conduits, for underground wiring for telephone and telegraph lines, are used in increasing numbers.

There are no potteries in the State, so far as can be learned, for the manufacturing of fine wares. One pottery at Louisville manufactures flower pots.

## ANALYSES OF TYPICAL CLAYS TAKEN FROM VARIOUS AUTHORS

## KAOLIN

	Silica....	Alumina.	Iron.....	Lime....	Magnesia	Alkalies.	Water...
1. King-to Chin, China.....	73.55	21.00	.....	2.55	.55	.....	2.62
2. Berlin, Germany.....	72.96	24.78	.....	.10	.....	1.22	.....
3. Sevres, France.....	58.00	34.50	.....	4.50	.....	3.00	.....
4. Cornwall (best), England....	46.30	39.70	.30	.40	.....	.50	12.80
5. Meissen, Germany.....	57.70	36.00	.80	.30	.....	*5.20	.....
6. Wilmington, Delaware.....	72.40	14.80	.....	.35	.....	.75	.....
7. Woodbridge, New Jersey....	44.10	39.36	1.40	.....	.....	14.90	.....
8. Lawrence County, Indiana....	39.00	36.06	.....	1.63	.....	.54	23.50
9. Inyo County, California....	44.74	33.23	1.08	.77	.23	2.24	17.56
10. Edwards County, Texas....	45.82	39.77	.....	.....	.....	.39	.....
11. Elgin, Scotland.....	39.30	38.52	.....	.75	.83	.....	19.54
12. Steinbruck, Styria.....	40.70	38.40	.....	.60	1.50	.....	18.00

## NEBRASKA GEOLOGICAL SURVEY

## BALL CLAYS

	Silica....	Alumina.	Iron....	Lime....	Magnesia	Alkalies.	Water...
1. Edgar, Florida.....	46.11	39.55	.35	.....	.13	.....	13.78
2. Burt's Creek, New Jersey....	44.40	38.34	.86	.....	.....	.44	14.60
3. South Amboy, New Jersey....	44.89	37.27	.97	.41	.19	1.44	14.47
4. Mayfield, Kentucky.....	56.40	30.00	.....	.40	.....	5.27	7.93
5. Wareham, England.....	55.00	29.71	2.14	.62	.....	3.44	10.84
6. Jefferson County, Missouri....	48.51	35.18	.92	1.01	1.47	2.30	10.72
7. Union, Missouri.....	44.14	39.86	.46	.77	.46	.71	13.84
8. Hall, England.....	39.60	45.00	.....	.10	3.30	.....	12.00

## FLINT CLAYS

1. Mineral Point, Ohio.....	52.52	31.84	.67	.50	.19	.59	11.68
2. Salinville, Ohio.....	59.92	27.56	1.03	.....	.....	.67	9.70
3. Beaver County, Pennsylvania.	65.85	22.87	1.14	.53	.37	2.01	6.93
4. Swallow Falls, Indiana.....	61.00	26.36	.83	.21	.10	.....	11.60
5. Tipton, Kentucky.....	46.75	38.17	.....	.11	.....	.56	14.03
6. Gorman, Kentucky.....	68.01	24.09	1.01	3.01	.....	.....	3.03
7. Learburg, Missouri.....	43.82	38.24	.23	1.93	.....	.73	14.94
8. Dry Branch, Missouri.....	42.60	41.88	.62	.28	.20	.54	14.00
9. Drake, Missouri.....	40.50	43.22	.31	1.10	.....	.51	14.15

## FIRE CLAYS

1. Stonebridge, England.....	65.1	22.22	1.92	.90	.....	.....	9.86
2. Glenberg Star, Scotland.....	65.41	30.55	1.70	.69	.64	.55	.....
3. Gairnkirk, Scotland.....	53.40	43.60	1.80	1.60	.....	.....	.....
4. Leeds, England.....	78.60	15.90	3.60	.84	.42	.29	.....
5. Limoges, France.....	52.55	26.50	.55	3.00	1.50	.....	16.55
6. Sevres, France.....	42.00	38.96	.85	1.04	.17	.....	19.23
7. Climax, Pennsylvania.....	42.82	40.20	2.59	.....	.35	1.24	12.80
8. Morrison, Colorado.....	71.80	15.00	.....	3.80	.....	.....	8.30
9. Hickman, Kentucky.....	84.92	10.56	1.10	.57	.11	.65	2.09
10. St. Louis, Missouri.....	61.22	25.64	1.70	.70	.08	.73	10.00
11. Greenup, Kentucky.....	46.75	37.17	.29	.57	.12	.07	14.03
12. Gruenstadt, Germany.....	47.33	35.05	2.30	.16	1.11	3.18	10.51

## STONEWARE CLAYS

1. Coblenz, Germany.....	55.28	24.19	1.00	.....	2.02	.....	5.76
2. Meillonau, France.....	59.00	22.00	5.05	3.85	.....	.....	11.00
3. Meillonau, France.....	57.26	16.04	12.00	2.15	4.52	.....	10.46
4. Roseville, Ohio.....	69.35	19.08	1.26	.60	.63	2.16	6.59
5. Putnam County, Indiana.....	66.18	21.15	5.30	.70	.14	.33	4.11
6. Bacon County, Maryland....	65.70	20.30	1.00	3.50	1.44	.62	7.60

## BRICK CLAYS

1. Indianola, Iowa (loess).....	63.31	16.57	4.06	1.11	1.10	3.16	10.65
2. Spencer, Louisiana (loess)...	52.42	13.04	6.24	7.98	2.25	8.08	6.73
3. Mason City, Louisiana (shale)	54.64	14.62	5.69	5.16	2.90	5.89	9.39
4. Cartersville, Georgia (alluv.)	69.18	15.43	5.83	.....	.71	1.98	6.85
5. Madison, Wisconsin.....	75.80	11.07	3.53	1.84	.08	2.11	3.70
6. Sayerville, New Jersey.....	60.18	23.23	3.27	1.00	.07	3.38	8.54
7. Garfield, New Jersey.....	73.71	11.09	4.30	2.31	1.71	3.29	3.93

## CLAY INDUSTRY OF NEBRASKA

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## TERRA COTTA CLAYS

	Silica....	Alumina.	Iron.....	Lime....	Magnesia	Alkalies.	Water...
1. Baltimore, Maryland.....	68.30	21.27	1.43	.52	.90	.20	7.55
2. Alfred Center, New Jersey...	53.90	23.25	10.90	1.01	.62	2.69	6.39
3. Billings, Montana.....	63.11	23.11	1.79	.42	.70	3.71	7.05
4. Woodbridge, New Jersey.....	44.20	38.66	.74	.....	.....	.46	13.55

## GLACIAL CLAYS

1. Chippewa Falls, Wisconsin...	71.77	13.74	3.60	1.23	1.17	3.50	5.00
2. Glenwood, Wisconsin.....	73.14	11.14	5.00	.97	.88	3.68	4.58
3. Marshfield, Wisconsin.....	68.74	10.65	3.16	3.81	2.73	4.00	6.55
4. Menomonie, Wisconsin.....	63.36	14.01	6.40	2.63	2.21	4.50	6.79
5. Merrillan, Wisconsin.....	62.59	17.42	5.88	.....	1.29	8.60	4.15
6. River Falls, Wisconsin.....	70.02	14.77	5.00	1.02	1.03	3.33	4.50
7. Tomahawk, Wisconsin.....	70.41	13.64	5.20	1.54	1.49	4.12	3.37
8. Whittlesey, Wisconsin.....	70.54	13.60	4.48	.70	1.41	4.30	4.10

## LOESS CLAYS

Kansas City, Missouri.....	72.00	11.97	3.51	1.80	1.35	3.25	5.42
Boonville, Missouri.....	71.11	11.62	3.90	2.37	1.47	3.14	6.71
Jefferson City, Missouri.....	74.39	12.03	4.06	1.50	1.53	3.01	3.17
Hannibal, Missouri.....	73.80	13.19	3.43	.86	.68	2.94	5.26
St. Louis, Missouri.....	73.92	11.65	4.74	1.43	.60	3.13	3.08

## ADOBE CLAYS

	Silica....	Alumina.	Iron.....	Lime....	Magnesia	Alkalies.	Carbonic Acid....	Organic Matter..	Water...
Santa Fe, N. M.....	66.69	14.16	4.38	2.49	1.28	1.88	.77	2.00	4.94
Ft. Wingate, N. M....	26.67	.91	.64	36.40	.51	.....	25.84	5.10	2.26
Humboldt, Nevada...44.64	13.19	5.12	13.91	2.96	2.30	.....	8.53	3.43	3.84
Salt Lake City, Utah 19.24	3.26	1.09	38.94	2.75	.....	.....	29.57	2.96	1.67

## SLIP CLAYS

	Silica....	Alumina.	Iron.....	Lime....	Alkalies.	Magnesia	Water...
Akron, Ohio.....	60.40	10.42	5.36	3.89	4.28	.87	8.05
Albany, New York.....	58.54	15.41	3.19	6.30	3.40	4.45	8.08

## FULLER'S EARTH

Reigate, Germany .....	53.00	10.00	9.75	.50	1.25	.....	24.00
England .....	44.00	11.00	10.00	5.00	2.00	5.00	21.00
Florida .....	62.83	10.35	2.45	2.43	3.12	.94	14.13
Georgia .....	67.42	10.08	2.49	3.14	4.09	.....	11.89
South Dakota.....	58.72	16.90	4.00	4.06	2.56	2.11	10.40



## NEBRASKA GEOLOGICAL SURVEY

## PAVING BRICK CLAYS

	Silica . . .	Alumina .	Iron . . . .	Lime . . . .	Magnesia	Alkalies .	Water . . .
Fort Smith, Arkansas . . . . .	58.43	22.50	8.35	.....	1.14	3.21	6.20
Cartersville, Georgia . . . . .	58.63	20.47	8.58	.....	1.42	4.00	7.06
Robbins, Kentucky . . . . .	51.56	15.56	7.68	7.27	.82	3.57	13.44
Columbus, Ohio . . . . .	58.38	20.89	5.78	.44	1.57	5.02	7.53
Massillon, Ohio . . . . .	64.10	21.79	2.51	.10	.58	2.65	6.05
Palestine, Ohio . . . . .	57.80	25.54	2.51	.25	.61	2.69	8.35
Clinton, Indiana . . . . .	43.14	40.87	3.44	2.01	.97	.02	9.48

## NEBRASKA CLAY INDUSTRY BY COUNTIES

A questionnaire was sent to each and every brickworker in the State and answers were received from the majority of them. However, the answers do not agree in all cases with the statements given in person. The discrepancies are few and of minor consequence, and it is believed that the report by counties is as nearly accurate as can be expected at this time.

## ADAMS COUNTY

Of the 5 important brick plants in Adams County, 4 are at Hastings and the fifth at Roseland. Adams County ranks third in the State in the production of brick.

Name of Plant	Town	Output	Value at Kiln	Approx.
Polinsky Brick Co. . . . .	Hastings	4,000,000 common	.....	\$ 25,000.00
		300,000 tile	.....	1,900.00
Polinsky-Shellak & Co. . . . .	Hastings	8,000,000 common, pavers, hollow tile	.....	72,000.00
Western Brick & Supply Co., Plant No. 1. . . . .	Hastings	6,000,000 common	.....	39,000.00
Western Brick & Supply Co., Plant No. 2. . . . .	Hastings	4,000,000 common, face	.....	30,000.00
Trausch Bros., Brick Plant . . . . .	Roseland	1,200,000 common	.....	9,000.00
Totals . . . . .		23,500,000	.....	\$176,900.00

## POLINSKY BRICK COMPANY, HASTINGS

The Polinsky Brick Company, also known as the Hastings Brick Company, was established in 1889 at Hastings under the firm name of Puls and Butzirus. Later the name was changed to Butzirus Brothers and Polinsky, then to Klose and Polinsky Brothers, and finally to Polinsky Brothers, who are now operating the plant.

The clay pit covers about 6 acres, and a section shows yellow-buff clay, loess, averaging 28 feet in thickness, with a foot or two of black surface soil. There are but few iron and lime concretions in the clay of this pit.

The mixers, moulds, and clay cars are operated by a 75 horse power steam engine provided with an 85 horse power boiler. The brick are shed-dried, and are burned for 14 days in a single continuous kiln having a capacity of 300,000 brick. The present working capacity of the kilns is 27,000 brick daily. The operation of the plant requires the services of 21 men at an average daily wage of \$2.15. The plant uses yearly 800 tons of coal at \$4.10 a ton. The kiln coal is shipped from Rock Springs, Wyoming, and the engine coal mainly from Monroe, Illinois.



The annual output is 4,000,000 common red building brick of good quality. Brick of the first quality retail at \$7.00 a thousand at the plant, while No. 2, and broken brick, retail for \$5.50 a thousand. The plant also manufactures about 300,000 hollow brick or tile, size 4x5x12 inches. The market for this brick is Nebraska, South Dakota, Wyoming, Colorado, and Kansas. Approximately 3 per cent is marketed at Hastings.

THE POLINSKY SHELLAK AND COMPANY, HASTINGS

The Polinsky Shellak and Company's plant at Hastings was established by Klose and Company in 1887. Later it was sold to Klose and Collins, who operated the plant from 1893 to 1900, when it was transferred to its present owners.

The clay pit covers about 4 acres and is excavated to a depth of 23 feet in loess. A section shows 3 layers, the upper 3 feet of dark buff clay, the middle, a one-foot layer of black loamy soil, and the bottom, 16 feet of fine textured, buff clay.

The mixers, moulds, and clay cars are operated by a 300 horse power steam engine. Three other small engines, 18, 25, and 40 horse power respectively, are used to operate the draft and driers. The brick are dried by artificial heat. The building brick are burned 14 days, and the paving brick 16 days. There are two continuous kilns, each 325 feet long, which have a capacity of 500,000 brick each. The machine capacity of the plant is 75,000 brick daily, while the daily kiln capacity is 50,000 brick. Each year 2,500 tons of coal at \$4.00 a ton are consumed. The kiln coal is secured from Rock Springs, Wyoming, and the steam coal from Wirth, Kansas.

The total annual output is 8,000,000 brick, including 4 varieties namely: building, paving, side walk, and hollow brick. The brick retails as follows:—building brick \$7.00 a thousand; paving brick \$20.00; side walk brick \$9.00; hollow brick, or tile, \$7.00 a thousand at the plant. The hollow tile and side walk brick are made of clay taken from the pit at the plant. The paving brick are made of light blue shale, containing a good per cent of iron, shipped from Steel City, Nebraska.

During 1911 90 per cent of the output was red building brick, while 10 per cent was paving and side walk brick, as no tile were manufactured. Heretofore, tile constituted 25 per cent of the output. Kansas, Nebraska, Colorado, Wyoming, and South Dakota use 85 per cent of the brick, while 15 per cent of the output is sold in Hastings itself.

WESTERN BRICK AND SUPPLY COMPANY, PLANT NO. 1, HASTINGS

The Western Brick and Supply Company of Hastings is the owner of two brick plants. Plant No. 1, located one mile southwest of Hastings, was established by the Western Brick and Supply Company in 1900. The plant consists of 9 buildings and covers 27 acres. The pit covering 6 acres, is 22 feet deep, in loess. A section shows 2 feet of black loam overcapping 20 feet of buff clay, loess, containing some lime and iron concretions.

The mixers, moulds and clay cars are operated by a 75 horse power Hamilton-Corliss engine. The brick are shed-dried, and are burned 14 days in 2 continuous kilns, each having a capacity of 500,000 brick. The daily working capacity of these kilns at the present time is 45,000 brick. The kiln coal is obtained from Rock Springs, Wyoming, and the engine coal from Wier, Kansas, totalling 1,500 tons during the year, at approximately \$4.00 a ton. Thirty men are employed by this plant at an average daily wage of \$2.50.

The annual output of Plant No. 1, of the Western Brick and Supply Company, is 6,000,000 common red building brick retailing at \$7.00 a thousand for No. 1, and \$6.00 a thousand for No. 2, at the yard. Hastings takes 10 per cent of the output, and although a little is sold in Wyoming, Colorado, and Kansas, about 90 per cent is marketed in Nebraska.

## NEBRASKA GEOLOGICAL SURVEY

## WESTERN BRICK AND SUPPLY COMPANY, PLANT NO. 2, HASTINGS

Plant No. 2 of this Company, located 1½ miles east of Hastings, was established in 1904 by P. Hemple and Company, who sold it in 1910 to the Western Brick and Supply Company.

The plant consists of 7 buildings, and covers 20 acres. The clay pit covers 3 acres, is 20 feet deep, and a section shows it to be composed of 18 feet of yellow-buff clay, loess, overlaid by 2 feet of black soil.

The mixers and moulds are operated by an 80 horse power steam engine. The brick are shed-dried without the use of artificial heat or drafts, and are burned from 8 to 12 days. This plant manufactures three varieties of brick, namely: red building brick, made from clay at the Company's pit; red building tile, size 4x5x12, constituting two-thirds of the output; and face brick, constituting 5 per cent of the output, which is made of blue shale shipped from Steel City, Nebraska. Three kilns are used, two of which are continuous, with a capacity of 300,000 brick each. The third is a small kiln for burning face brick having a capacity of 15,000. The 3 kilns have a daily working capacity of 35,000 brick. The services of 23 men, receiving a daily wage of \$2.10, are required to operate the plant. Each year, Plant No. 2 consumes 800 tons of kiln coal at \$4.25 a ton, from Rock Springs, Wyoming, and 500 tons of engine coal at \$4.00 a ton from Wier, Kansas.

The total annual output of Plant No. 2 is 4,000,000 brick retailing at \$6.50 a thousand for the red building brick and tile, and \$12.00 a thousand for face brick. Although Kansas, Colorado, and Wyoming use a small per cent of the output, 95 per cent is marketed in Nebraska, of which 5 per cent is local.

## TRAUSCH BROTHERS BRICK PLANT, ROSELAND

The Trausch Brothers Brick Plant was established at Roseland in 1909 by the present owners. The plant consists of 7 buildings and covers 9½ acres. The clay pit, which is 20 feet deep and covers half an acre, is composed entirely of buff clay, loess, with lime concretions.

The mixers and moulds are operated by E. M. Fresse machinery, and a Chamber K. Taler steam engine with a 125 horse power boiler. The brick are dried by steam in open sheds. One up-draft continuous kiln is used, which has a working capacity of 40,000 brick every 24 hours. Fourteen men, receiving a daily wage of \$2.00, are employed. Each year the plant uses 300 tons of kiln coal at \$3.60 a ton from Sheridan, Wyoming, and 420 tons of coal at \$3.30 a ton from Noomgar, Missouri, and Wier, Kansas.

The annual output is 1,200,000 common red building brick which retail at \$7.50 a thousand for No. 1, and \$6.25 a thousand for kiln run. About 66 per cent of the output of this plant is marketed in Adams County, the balance in Roseland and vicinity.

## ANTELOPE COUNTY

There are 2 brick yards in Antelope County, both of them located at Neligh. Together they produce about 2,200,000 brick annually.

Name of Plant	Town	Output	Approx. Value at Kiln
The Northwestern Brick Works	Neligh	1,200,000 common	\$ 8,400.00
The Neligh Brick Works	Neligh	1,000,000 common	7,500.00
Totals		2,200,000	\$ 15,900.00

## THE NORTHWESTERN BRICK WORKS, NELIGH

This plant, located one mile north of Neligh, was established by Mr. McDonald. He transferred the plant to McKama and Meginessy, who sold it to the present owner, Mr. Broder Kitilsen.

The clay pit covers two acres, and a section gives an average of 25 feet of yellow loess clay with a cap of black soil. This loess clay makes a good quality of brick. The plant covers about half an acre and consists of a shed and two kilns of the up-draft type, each having a capacity of 150,000 brick. The operation of the plant requires the labor of 7 men at an average wage of \$2.00 a day.

From 300 to 400 tons of kiln coal and 100 tons of engine coal are consumed annually. Both the kiln and engine coal are shipped from Franklin County, Illinois, costing on an average \$4.70 a ton.

The average annual output is 1,200,000 common red building brick retailing at \$6.50 to \$7.50 a thousand. These are marketed locally, and in towns along the Northwestern Railroad.

THE NELIGH BRICK WORKS, NELIGH

The Neligh Brick Works were established about 1885 by the present owner, T. H. Brenton. In 1901 the plant was moved to its present site, a half mile east of Neligh. The plant, including the pit, covers about 1½ acres, the pit alone three-quarters of an acre, which shows, in a section, 50 feet of buff-gray loess clay, capped with soil.

The mixers are run by a 40 horse power steam engine. There are 3 kilns of the up-draft type, having a capacity of 160,000 brick per kiln. Their present working capacity is 25,000 to 30,000 per day. Ten men, at an average wage of \$2.25 a day, are employed to operate the plant. Three hundred tons of coal, at a cost of \$4.00 a ton, are consumed annually. This is shipped from Indiana, Iowa, Illinois, and Missouri. The brick are shed-dried by the aid of steam pipes, and are burned from 8½ to 9 days. The annual output is 1,000,000 common red building brick which retail at \$7.50 a thousand, and are marketed in north-western Nebraska and southern South Dakota.

BOX BUTTE COUNTY

Box Butte County has but one brick plant, situated at Alliance.

Name of Plant	Town	Output	Approx. Value at Kiln
Rick Brick Yard.....	Alliance	600,000	\$6,000

THE RICK BRICK YARD, ALLIANCE

This plant was established by its present owner, S. C. Rick, in 1904, at Alliance, Nebraska. The plant covers approximately 2½ acres, the pit 1½ acres. A section shows 6 feet of material in two layers, the upper light, and the lower buff clay.

Two kilns are used, the up-draft having a capacity of 100,000 brick, the down-draft a capacity of 40,000 brick. The brick are air-dried and burned 4 days. A 15 horse power electric motor is used. The operation of the plant requires the services of 7 men at a daily wage of \$2.50. Four hundred tons of coal, at \$5.00 a ton, shipped from Sheridan, Wyoming, are consumed annually. The average yearly output of this plant is 600,000 common red building brick sold at \$10,00 a thousand.

BUFFALO COUNTY

The Hibbard Brick Company in Kearney is the only brick plant in the county.

Name of Plant	Town	Output	Approx. Value at Kiln
Hibbard Brick Co.....	Kearney	10,000,000	\$80,000.00

THE HIBBARD BRICK COMPANY, KEARNEY

The plant of the Hibbard Company, located on Avenue A, 34th Street, Kearney, was organized by Mr. Hibbard, the present owner. The plant, including the pit, covers 16 acres, the pit alone covers 4 acres. A section shows that

the pit is 60 feet deep. There are 3 layers of alluvium, the upper 4 feet of dark buff, the middle 5 to 6 feet of a lighter buff, and the lower 10 feet of light buff alluvium. In making brick the clay from the three layers is mixed.

The brick are steam dried and burned for 9 days. The mixers are run by steam. An automatic cut-off steam engine of 125 horse power is used to operate the plant. There are 7 kilns, 4 down-draft with a capacity of 320,000 each, and one continuous kiln with a capacity of 500,000 brick. The plant employs 25 men at an average wage of \$2.00 a day. In the manufacture of 1,000 brick, a half ton of coal, costing \$5.50 a ton, is used. This coal is shipped from Iowa and Rock Springs, Wyoming. The engine coal costs \$4.25 a ton. The annual output of the plant is 8,000,000 brick; when in full operation 10,000,000; but during the year 1913 only 2,000,000 were put out. These brick are an excellent quality of common red building brick, retailing at \$8.00 a thousand.

We quote from Mr. Richard Hibbard's correspondence the following: "We have had our clay tested at Bucyrus, Ohio, for press brick and in Burslem, England, for encaustic tile, and it is pronounced better than clay used for said manufacture in England. Samples of each in our office."

## BURT COUNTY

Burt County has but one brick plant, now abandoned.

## OAKLAND BRICK COMPANY, OAKLAND

Previous to 1909, a brick yard, known as the Oakland Brick Company's plant was located one-fourth mile northwest of Oakland. It was organized by Andrew Anderson, and was later transferred to the Oakland Brick Company. It proved unprofitable and is now abandoned.

When in operation there were 16 buildings, the plant covering 15 acres. There were 2 large kilns, one a continuous kiln of 400,000 brick capacity, the other having a capacity of 300,000 brick. The clay pit covers 5 acres and consists of yellow loess clay, throughout which are scattered, from top to bottom, many small fossil shells. Only common red brick were manufactured.

## CASS COUNTY

There is but one brick plant in Cass County, located at Plattsmouth.

There are 3 common stove kilns with a capacity of 150,000 brick each, requiring the labor of 5 men at an average daily wage of \$1.75. The two mixers and moulds are run by horse power. The rack pallet system is used in drying the brick. Two hundred and fifty cords of wood are consumed annually in the manufacture of 500,000 common red brick, retailing at \$7.00 to \$8.00 per thousand locally. In the meantime this plant has been temporarily abandoned.

## CEDAR COUNTY

There is but one brick plant in Cedar County, The Hartington Brick Works, located about ½ mile southeast of Hartington. It is owned by Mr. John Lammer, who established the plant in 1902.

Name of Plant	Town	Output	Approx. Value at Kiln
The Hartington Brick Works	Hartington	350,000	\$3,150.00

## THE HARTINGTON BRICK WORKS, HARTINGTON

The plant covers 1 acre, the pit 3. The clay used in the manufacture of brick is of one variety, a buff shale, which is taken exclusively from a railroad cut of the Chicago, St. Paul, Minneapolis and Omaha railroad. The pit is 18 feet deep, and a section is as follows:—the bottom of the cut for 4 to 7 feet is yellow loess clay, then 2 to 4 feet of a darker clay, probably loess, black loam next, and on top of this a 2-foot layer of black loam capped by 3 feet of buff clay.



There are 2 kilns, having a capacity of 50,000 and 100,000 brick respectively. A 10 horse power engine is used to operate the machinery. The labor of 9 men, at an average daily wage of \$2.25 is required to operate the plant. The annual consumption of coal is 200 to 300 tons costing \$5.00 to \$6.50 a ton, shipped mostly from Iowa. The brick are dried by the rack system, and are burned for about 7 days. The plant has an annual output of 350,000 common red building brick, retailing at \$9.00 to \$10.00 a thousand and are disposed of locally.

CLAY COUNTY

Clay County at one time had 2 brick yards, one at Edgar, and one at Sutton, but both of these have been abandoned. The one at Edgar was owned and operated by William H. Graham, until about 1908. At Sutton, a small yard was established in 1906 by Samuel Huntsinger, who operated the plant until 1909. The clay at this point was counted poorly adapted to the manufacture of good brick.

CUMING COUNTY

There are 2 brick plants in this county, one located at Wisner, the other, now abandoned, at West Point.

Name of Plant	Town	Output	Approx. Value at Kiln
Benzein Brick Works	Wisner	1,000,000	\$7,500.00

BENZEIN BRICK WORKS, WISNER

In 1886 Herman Benzein started a brick yard at Wisner. The plant covers about 1½ acres, while the pit covers 14 acres, and consists of 20 feet of yellow drift clay.

One kiln of a capacity of 200,000 brick is used, and requires the labor of 6 men, each receiving \$2.50 a day. The clay mixers are run by steam. The brick are shed-dried by the use of hot air, before being baked. The annual consumption of coal is approximately 280 tons, at an average cost of \$5.50 a ton. This is shipped from Rock Springs, Wyoming. The yearly output is 1,000,000 brick retailing at \$7.50 a thousand.

WEST POINT MILLING COMPANY, WEST POINT

In 1879 the West Point Manufacturing Company established a plant at West Point. Later it was transferred by them to the West Point Investment and Land Improvement Company, and again transferred to its present owners, the West Point Milling Company. This Company abandoned the plant in 1910 because of the scarcity of reliable labor, and the high price of the same. Besides, the equipment was not sufficiently up-to-date to compete with modern plants using labor-saving machinery.

When in operation, the plant covered 3½ acres and used 3 kilns of a capacity of 175,000 brick each. The brick were shed-dried without the use of hot air. Twelve men, at a salary of \$2.50 a day, were employed to operate the plant. Three hundred and seventy-five tons of Iowa coal at \$4.00 a ton were used yearly. The annual output was about 1,000,000 brick.

DAWES COUNTY

There are two brick plants in Dawes County, both in Chadron.

Name of Plant	Town	Output	Approx. Value at Kiln
Chadron Press Brick Company	Chadron	300,000	\$3,600.00
Broghamer & Pittman Brick Plant	Chadron	500,000	5,000.00
<b>Totals</b>		<u>800,000</u>	<u>\$8,600.00</u>

## NEBRASKA GEOLOGICAL SURVEY

## THE CHADRON PRESS BRICK COMPANY, CHADRON

This plant was established northwest of Chadron by Messrs. Ira and Elmer A. Longcor in 1900. There are 3 buildings, and the plant covers about 2½ acres. One down-draft kiln of 60,000 capacity, and one up-draft kiln of a capacity of 85,000 brick are used. The mixers and moulds are operated by a 40 horse power gasoline engine known as the Era. The brick are dried in sheds without the aid of hot air and burned for 10 days. They are common red building brick, retailing at \$12.00 a thousand, and are marketed locally. Eight men, at an average wage of \$2.50 a day, are employed. About 120 tons of coal at \$5.00 a ton are used. This is shipped from Hudson and Rock Springs, Wyoming. The clay pit covers 1½ acres and is composed of 5 feet of bluish-buff clay. The annual amount of brick at this yard is about 300,000.

## BROGHÁMER AND PITMAN BRICK PLANT, CHADRON

The other brick plant located in Chadron was established by Broghamer & Pitman in 1907. The plant and pit together cover 3 acres. Two down-draft kilns of a capacity of 10,000 brick each, are used. Only soft and hard common red building brick are manufactured. The hardness of the brick is due to their position in the kiln, the soft brick coming from the top, while the hard come from the bottom where the heat is more intense. A 15 horse power engine is used. The brick are shed-dried without the aid of hot air. Six men, at an average daily wage of \$2.25 are employed. The coal used is shipped from Colorado, and Sheridan, Wyoming, and during the season amounts to 125 tons, at a cost averaging \$4.50 a ton. The annual output of brick is 500,000, selling at about \$10.00 a thousand. The clay pit covers ¼ acre and is composed of bluish-colored clay, very shaley in places, with many scattered green colored patches.

## DAWSON COUNTY

Dawson County had but one brick plant, the Wirges Brick Yard at Lexington. The plant is now abandoned.

## THE WIRGES BRICK YARD, LEXINGTON

The Wirges Brick Yard is located one mile north of Lexington. It was established in 1893 by John Wirges. According to the informant, this was a most promising plant, with plenty of good material, but was abandoned in 1909.

When in operation there were 6 buildings, and the plant covered 10 acres. The pit covered 2 acres and a section showed 16 to 20 feet of clay. Four kilns, the round and square type, with a capacity of 400,000 brick each were used. The brick manufactured were the common red building brick, which were first sun-dried, then burned from 14 to 16 days. During the year 1,000,000 brick were manufactured and marketed in Dawson County and vicinity at prices ranging from \$8.00 to \$11.00 a thousand. Fifteen men, at an average daily wage of \$2.00, were employed to operate the plant. The coal used by this plant was shipped from Wyoming and cost \$4.00 a ton.

The plant, kilns, and machinery have all been destroyed. Lexington is reported to be an especially favorable location for a good brick plant.

## DODGE COUNTY

In Dodge County there are 6 brick plants upon which to report, only 3 of which are now operating.

Name of Plant	Town	Output	Approx. Value at Kiln
The Hooper Brick Co.....	Hooper..	700,000 .....	\$ 6,300.00
The Builders Brick Co.....	Hooper..	4,000,000 .....	28,000.00
Andrew Mumedery Brick Co..	Dodge..	300,000 .....	2,700.00
Totals .....		5,000,000 .....	\$37,000.00

## THE HOOPER BRICK COMPANY, HOOPER

This plant, located about 300 yards southeast of The Builders Brick Manufacturing Company, was established by Carl Bayer in 1893. The plant was later transferred to W. F. Basler of Hooper, who transferred it to W. F. Bayer of that place.

The plant covers 5 acres, and the pit also covers 5. A section of this pit shows it to consist of 22 to 25 feet of a sandy, yellowish-buff clay. It is interesting to note, in this connection, that the clay bank, during July at the time it was visited by our survey representative, contained 199 bank swallows, (*Riporia riporia*), nesting burrows, and that fully half of this number contained young birds.

Two down-draft kilns are used, one having a capacity of 50,000, the other of 60,000 brick. The brick are shed-dried without the use of hot air, and are then burned 8 to 9 days. This requires the labor of 7 men at an average wage of \$2.10 a day. The coal used by the Company is shipped in from Missouri, Illinois, and Iowa, and costs from \$3.50 to \$4.25 a ton. One ton is used for every thousand brick burned. The annual output is about 700,000 common red building brick which retail at \$9.00 a thousand for No. 1.

## THE BUILDERS BRICK COMPANY, HOOPER

The Builders Brick Company, located half a mile west of Hooper, was established by John Heinrich in 1873. This plant has 6 buildings, and owns 160 acres. The pit covers 3 acres. A section shows 25 feet of sandy yellow-buff clay.

There are 8 down-draft kilns, 7 of which have a capacity of 60,000 brick each, while the other has a capacity of 180,000. The present working capacity of the kiln is 32,000 brick a day. A 185 horse power slide valve engine is used. The brick are dried without the aid of hot air, and are then burned 3 to 8 days. This requires the labor of 27 men at an average daily wage of \$2.10. Two thousand tons of Illinois coal at \$3.85 a ton are consumed each year. The plant manufactures 4,000,000 hard and soft red building brick each year. These are marketed in towns along the Chicago & Northwestern Railroad, retailing at \$7.00 and \$8.00 a thousand.

## ANDREW MUMEDERY BRICK COMPANY, DODGE

The brick yard at Dodge was established at 1870 by Max Loeding who sold it to Peter Miller. It was again transferred to its present owner, Andrew Mumedery.

The plant, including the pit, covers 5 acres, the clay pit showing 18 feet of yellow loess clay. Five men, at an average daily wage of \$2.00, operate the plant. One kiln of a capacity of 150,000 brick is used. The brick are shed-dried before being burned. The consumption of coal each year is 60 tons at \$5.00 a ton. The annual output of the plant is 300,000 common red building brick, which retail at \$9.00 a thousand.

## THE SNYDER BRICK PLANT, SNYDER

The brick yard at Snyder was abandoned in 1910 although the clay is extra good. The plant, however, was old, the machinery not modern and was in need of remodeling. The owner tried to arouse interest in its reconstruction, but was unsuccessful.

## THE FREMONT GRANITE BRICK COMPANY, FREMONT

The Fremont Granite Brick Company was established in Fremont in 1909, but is not in operation at the present time. It has 2 buildings and covers 2 acres. The sand pit covers 20 acres and is 30 to 40 feet deep. The working capacity of the kilns was 20,000 brick daily. The mixers and moulds were run

by steam, and a 16 x 36 Atlas Corliss engine was used. Ten men were employed at an average daily wage of \$2.50. The plant consumed annually 1,200 tons of coal at \$3.25 a ton.

The Company manufactured exclusively a sand-lime brick in a variety of shades. The annual output was 3,500,000 brick which retailed in a local market for \$8.00 a thousand.

THE SCRIBNER BRICK MANUFACTURING COMPANY, SCRIBNER

The plant of the Scribner Brick Manufacturing Company, now abandoned, is located  $1\frac{1}{4}$  miles northeast of Scribner. It was established by Henry Edelmaier in 1893. Later it was transferred to Theo Felgner, then to Richard Felgner, and again to Henry Edelmaier of Hooper, who is its present owner.

The plant covers  $4\frac{1}{2}$  acres, and the pit half an acre. A section shows it to be 20 feet deep and composed of 3 layers, as follows:—top, 5 feet of black loam; middle, 3 feet of dark clay; bottom, 12 feet of lighter clay. The northeast part of the pit is a bank of very fine sand or alluvium, extending up to within 3 feet of the surface. In the southwest portion of the pit is a patch about 10 yards square of a mixture appearing to be blue shale and buff clay. The mixers and moulds were run by gasoline engines. The brick were shed-dried before burning in 1 kiln having a capacity of 90,000 brick. This required the labor of 5 men, receiving a daily wage of \$2.25. The plant consumed about 200 tons of Iowa coal annually, at an average cost of \$4.25 a ton. Previously they had used Illinois coal. The annual output of this yard was 500,000 soft and hard common red building brick.

DOUGLAS COUNTY

In Douglas County there are 7 brick plants, 3 of which have been abandoned.

Name of Plant	Town	Output	Value at Kiln Approx.
Livesey Brick Co.....	Omaha..	3,000,000	\$ 7,500.00
Omaha Brick Co.....	Omaha..	7,500,000	52,500.00
Smith Brick Co.....	Omaha..	20,000,000	160,000.00
South Omaha Brick Yard.....	South Omaha..	2,500,000	22,500.00
Totals .....		33,000,000	\$242,500.00

THE MILLARD BRICK PLANT, MILLARD

The brick yard at Millard has not been in operation since 1905. At that time it was owned by Mr. D. N. Johnson. Only a fragment of a kiln remains, and we were unable to secure data respecting it.

THE FLORENCE BRICK PLANT, FLORENCE

The brick plant located at Florence, which was owned by Mr. Charles Hanson, has also been abandoned.

THE OMAHA BRICK & TILE COMPANY, OMAHA

The plant of this Company is located at 2nd and Hickory streets in Omaha. It was established by The Omaha Pottery, Brick, and Tile Company, who transferred it to the present owners. The plant covers 2 acres, and the clay pit, which covers three-fourths of an acre, varies from 3-20 feet in depth, and is located at Louisville, Nebraska. It consists of white, buff, and red clays and shales. The plant has not been in operation since 1911. At that time it had 9 kilns, each with a capacity of 90,000 brick. The brick were dried with crude oil, and were of the common red building brick type, and of Haverstraw variety.



During the year 1,500 tons of coal, costing \$3.90 a ton were used. Twenty-five men, receiving a daily wage of \$2.25 were engaged to operate the plant. Most of the clay used was secured at Louisville, although some was secured at Nehawka. The annual output of brick and tile averaged about 8,500,000.

LIVESEY BRICK COMPANY, OMAHA

The brick yard established in Omaha by Henry Livesey in 1906 has been incorporated under the name of the Livesey Brick Company.

The plant, together with the pit, covers 5 acres and the pit consists of 75 feet of loess clay. The mixers, moulds, and other machinery are operated by a 65 horse power Hamilton Corliss engine. The brick are dried in a steam tunnel, and then burned for 5 days in a continuous or tunnel kiln having a capacity of 500,000 brick. The present working capacity of the kiln is 750,000 a month. Twenty-five men, receiving a daily wage of \$2.25, are employed. During the year 625 tons of kiln coal costing \$2.70 a ton are shipped from Cherokee District, Kansas, and 1,000 tons of engine coal, costing \$3.35 a ton, from the same place. The annual output is 3,000,000 common red building brick which retail in Omaha and vicinity for \$7.50 a thousand.

THE OMAHA BRICK COMPANY, OMAHA

The Omaha Brick Company, located at 2nd and Dorcas streets, Omaha, was organized about 25 years ago by Cooper & Goodman. The plant covers approximately 17 acres. The clay pit is 60 feet deep, and consists entirely of yellow-buff clay. The brick are dried in long brick tunnels by means of hot air, and are then burned in a kiln having a capacity of 600,000 brick. It requires 2,000 tons of coal each year to operate the machinery and burn the brick. The annual output is 7,500,000 common red building brick.

THE SMITH BRICK COMPANY, OMAHA

The Smith Brick Company of Omaha has 2 plants, one located at 31st and Lake streets, and the other located at 24th street and Woolworth Avenue. The plant originally belonged to B. Ittner & Withnell Brothers. Altogether there are 10 buildings, and the plants cover 18 acres. The clay pits cover 18 acres, are part of the yard sites, and are composed of 10 to 25 feet of buff clay.

The mixers, moulds, and other machinery are operated by Corliss steam engines of 120 and 125 horse power respectively. The brick are dried in sheds heated by steam, and are burned about 3 weeks in 3 continuous kilns having a present working capacity of 2,000,000 brick. The services of 90 men, at \$2.25 a day, are required to operate the plant. The plant consumes annually 4,000 tons of kiln coal at \$2.75 a ton shipped from southern Illinois and Wyoming, and about 7,000 tons of engine coal, at \$3.50 a ton, mostly from Kansas.

The annual output of this yard is about 20,000,000 common building brick, and sand faced brick, which retail locally at \$7.50 to \$8.00 a thousand for common brick, and \$10.00 a thousand for the sand brick.

THE CORNEER BRICK COMPANY, OMAHA

The Corneer Brick Plant was originally owned and operated by Corneer & Craft, later by Corneer Brothers & Craft, followed by Corneer Brothers, and it has been reorganized as the Corneer Brick Company. The plant was established in 1900, and was located on 24th street in Omaha, but recently ceased operations. The plant and pit together covered about 6 acres. The clay pit is about 20 feet deep and is composed entirely of loess.

There were 4 kilns of a capacity of 300,000 brick each. These required the labor of 15 men at an average wage of \$2.25. The plant consumed annually 1,500 tons of coal, at an average cost of \$4.50 a ton. The annual output of the plant averaged 3,000,000 brick, which were of 2 varieties.

## NEBRASKA GEOLOGICAL SURVEY

## THE SOUTH OMAHA BRICK YARD, SOUTH OMAHA

The brick yard owned by Mr. J. H. Kritenbrink is located at 28th and V streets in South Omaha. The plant was established in 1893 by Ayers & Bock, who later transferred it to Burness, Parks & Broadnill, they in turn transferring it to Mr. Kritenbrink.

The plant covers  $4\frac{1}{4}$  acres. All clay used in the manufacture of their brick is taken from the pit at the plant which covers  $\frac{3}{4}$  of an acre and consists of 18 feet of yellow-buff clay. The mixers, moulds, and other machinery are operated by an Atlas engine. The brick are shed-dried, and are burned for a period of 14 to 15 days in 3 up-draft kilns having a capacity of 300,000 brick each. This requires from 1,000 to 1,100 tons of kiln coal, costing about \$4.00 a ton, and 175 tons of engine coal, at the same price per ton, to run the plant one year. The coal is obtained mostly from Missouri and Iowa. Besides this 250 tons of coke, ranging from \$8.00 to \$8.50 a ton, are annually consumed. Eighteen men, receiving a daily wage of \$2.25, are employed to operate the plant, which manufactures during the year 2,500,000 stiff process and sand brick of the hard variety. These retail at \$9.00 a thousand and are sold at wholesale for \$7.50 a thousand.

## FILLMORE COUNTY

Fillmore County has but one brick plant, that of the A. Koehler Company, established in 1895, and located  $\frac{1}{2}$  mile south of Geneva.

Name of Plant	Town	Output	Approx. Value at Kiln
A. Koehler Company	Geneva	2,500,000	\$17,500.00

The plant covers  $8\frac{1}{2}$  acres. One continuous kiln with a capacity of 285,000 brick is used. The daily working capacity at the present time is 18,000 brick. A 75 horse power Great Western steam engine, and 2 boilers, one of 80 and one of 125 horse power, are used to operate the moulds, clay conveyors, drafts, and so forth. Twenty men at an average daily wage of \$2.25 are employed. This plant used 480 tons of kiln coal from Kearney, Wyoming, at \$3.50 a ton. The engine coal comes from Wier, Kansas, and 480 tons at \$4.30 a ton are used.

The clay pit covers  $1\frac{1}{2}$  acres and is 30 feet deep. A section gives the following:—2 feet of loam on top; 10 feet of buff clay; 3 feet of reddish-brown clay; 5 feet of reddish-buff clay; and 10 feet of light buff at the bottom. These are mixed together in making the brick, which are shed-dried by the aid of the waste steam from the boilers. The season for manufacturing the brick is from the middle of April to the last of October. The brick are the common red building brick, of fair quality, and the annual output is 2,500,000, retailing at \$5.50 per thousand for kiln run, and \$7.50 per thousand for No. 1. Ten per cent of the output is sold in Geneva. 15 per cent in Fillmore County, and the remainder is marketed in other parts of Nebraska.

## FURNAS COUNTY

There is but one brick yard to be reported upon in this county, namely, the plant of Mr. Wm. Kailey,  $\frac{1}{2}$  mile south of Arapahoe. A brick yard was formerly located at Beaver City but this has not been in operation for several years, and we were unable to secure data relative to it.

Name of Plant	Town	Output	Approx. Value at Kiln
Wm. Kailey Brick Plant	Arapahoe	800,000	\$8,000.00

## WM. KAILEY BRICK PLANT

In 1887 a brick plant was established half a mile south of Arapahoe by William Kailey, the present owner. This plant covers one acre. There are 3 dry sheds, and 3 up-draft kilns, 2 having a capacity of 200,000 brick per kiln,

and the other a capacity of 100,000 brick. The present working capacity of the kilns is 7,500 brick daily. The mixers and moulds are run by horse power. The brick are shed-dried without the use of hot air, and are burned for 7 days. The labor of 8 men, at an average daily wage of \$2.00, is required. Four hundred tons of coal at \$5.00 a ton are shipped in from Sheridan, Wyoming, and annually consumed by this plant.

The clay pit covers 2 acres and consists of 10 feet of light buff clay, intermingled with many lime concretions. The annual output averages 800,000 of the ordinary red building brick, but only 260,000 brick have been manufactured this season. These brick, which retail at \$10.00 a thousand for No. 1, and \$6.50 a thousand for kiln runs, are marketed from Oxford, Nebraska, to Yuma, Colorado, along the Republican branch of the Chicago, Burlington & Quincy Railroad, not more than 5 per cent being sold out of the State.

FRONTIER COUNTY

In Frontier County there is but one brick yard to be reported.

Name of Plant	Town	Output	Approx. Value at Kiln
P. Simpson & Son's Brick Yard .....	Curtis	500,000	\$5,000.00

P. SIMPSON & SON'S BRICK YARD, CURTIS

This small plant was established in 1909 by P. Simpson & Son. Operations were discontinued for a time, but the plant is manufacturing brick again this season. Mr. P. Simpson gave us the following information:—The plant and pit together cover 3 acres. One up-draft kiln is used and the mixers and moulds are run by horse power. During the year the plant consumes 125 tons of coal, shipped from Colorado and Wyoming, the average cost being \$5.00 a ton. Seven men are employed at a daily wage of \$2.00. The annual output is 500,000 common red building brick, which retail at \$10.00 a thousand for No. 1, and \$8.50 a thousand for kiln run. A ready local market is found for these brick.

GAGE COUNTY

Name of Plant	Town	Output	Approx. Value at Kiln
Beatrice Brick Works.....	Beatrice	2,600,000	\$16,900.00

BEATRICE BRICK WORKS, BEATRICE

Some 20 acres comprise the holdings of this Company, which was established in 1902. There are available for use some 40 to 50 feet of shale with an overburden of 8 to 10 feet of drift. Common building brick and hollow tile are produced. There are 7 dry sheds with a total capacity of 683,000 brick. The building brick are dried for 3 weeks, the hollow tile for 10 days. The kilns are of the continuous type and the brick are burned about 12 days. It requires 30 men to operate the plant. The coal comes from Rock Springs, Wyoming, at a cost of \$3.75 a ton. The annual output is 2,600,000 brick, retailing at \$6.50 a thousand.

GREELEY COUNTY

The brick plant at Spalding, the only one in Greeley County, was established in 1902 by its present owner, H. O. Van Watermulen. The plant was abandoned in 1911 because the clay was becoming poor.

The clay pit is about 30 feet deep, but the intermingling iron and lime concretions, together with clay and fossil shells, makes the southern portion of the pit of no use for brick-making. The northern part of the pit consists of buff clay, considerably coarser than that in the south end, which makes a very good quality of brick.

When in operation, 2 up-draft kilns were used. One of these has been rebuilt into a house, and the owner and his family now reside there. Each kiln had a capacity of 125,000 brick with a daily working capacity of 4,000 brick. The brick were sun-dried before being burned. For this purpose 65 tons of coal were consumed annually. Four men were hired, receiving a remuneration of \$2.00 a day and their board.

## HALL COUNTY

There is but one brick yard now in operation in Hall County.

Name of Plant	Town	Output	Value at Kiln
C. Klose & Co.....	Doniphan..	6,000,000 .....	Approx. \$48,000.00

## C. KLOSE &amp; COMPANY, DONIPHAN

The plant of this company, located at Doniphan, covers 12 acres. Two up-draft kilns are used. Each kiln has a capacity of 400,000 brick with a daily working capacity of 50,000 brick. The mixers and moulds are run by a 65 horse power steam engine of the horizontal type. The brick are first shed-dried then burned for 10 days. For this purpose 600 cars of coal, shipped from Rock Springs, Wyoming, and costing \$4.50 a ton, are annually consumed. The labor of 43 men, receiving a daily wage of \$2.50, is required. The clay pit covers 8 acres, and a section shows it to be 30 feet deep, and to consist of 2-layers, a 2-foot layer of black loam overcapping 28 feet of yellow alluvium. The annual output of this plant is 6,000,000 common red building brick, which are of good quality.

Mr. Louis Schmidt at one time owned a brick yard at Grand Island, but this has been abandoned.

## HAMILTON COUNTY

There is one brick plant in Hamilton County.

Name of Plant	Town	Output	Value at Kiln
Aurora Brick Works.....	Aurora..	4,000,000 .....	Approx. \$28,000.00

## AURORA BRICK WORKS, AURORA

The Aurora Brick Works, organized by the C. Klose Company in 1904, covers 10 acres altogether. Two continuous kilns, each having a capacity of 200,000 brick are used. The daily machine capacity of the plant is 40,000 brick, the kiln capacity 30,000. The mixers and moulds are run by electricity, the city furnishing the power. The brick are shed-dried without the use of hot air, and are then burned for 14 days. This requires 425 tons of coal, which are shipped from Sheridan, Wyoming, and Route County, Colorado, costing the Company \$4.25 a ton. Thirty men, at an average wage of \$2.15 a day, operate the plant.

The clay used for brick-making is all taken from the pit at the plant. The pit covers 4 acres and averages 25 feet in depth. The top 30 inches consists of buff-clay, and beneath this is a 2-foot layer of loamy soil, which gradually blends into the main stratum, which is a 20-foot layer of rather coarse texture clay. This makes a very good quality of brick. The annual output of this plant is 4,000,000 common red building brick which retail at \$7.00 a thousand.

## HARLAN COUNTY

Little data was obtainable relative to the Orleans Brick Company's plant at Orleans. It was established in 1906 and closed in 1907. When in operation the plant covered 3 acres, and used 2 down-draft kilns. The principal owners in the Company were J. H. Gardner, J. B. Holland, and Carl Furgeson.



CLAY INDUSTRY OF NEBRASKA

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HOWARD COUNTY

Name of Plant	Town	Output	Approx. Value at Kiln
Gruber Brick Plant.....	St. Paul..	800,000.....	\$ 4,800.00

THE GRUBER BRICK PLANT, ST. PAUL

The brick plant at St. Paul, the only one in this county, was established by Mr. A. Gruber in 1879. The plant and clay pit together cover 8 acres. One continuous up-draft kiln, having a capacity of 100,000 brick is used. The daily working capacity of the plant is 10,000 brick. It requires 10 men, at an average wage of \$2.00 a day, to operate this plant. The coal used by the Company is shipped from Sheridan and Rock Springs, Wyoming, and from Kansas City, Missouri. Some 200 tons, costing \$5.00 a ton, are consumed each year.

The clay bank is 6 feet deep, and a section shows it to consist of 4 layers; the upper, dark loam; the second, yellow clay; the third, clay streaked with lime; and the bottom, a layer of buff-blue clay. The mixers and moulds are run by a 35 horse power gasoline engine. The brick, which are of the common red building variety, are shed-dried and then burned for 10 days. The annual output is 800,000 brick, which are of a medium quality.

JEFFERSON COUNTY

Although no brick plant is reported from this County, considerable amounts of brick clay are produced. From a pit 3 miles north of Steel City, on the St. Joseph & Grand Island Railroad, some 800 car loads of clay of the Dakota formation are shipped annually to the brick plants at Hastings. From another pit about 1/2 mile southeast of Steel City 150 car loads of clay are mined and shipped to Hastings.

KEARNEY COUNTY

Name of Plant	Town	Output	Approx. Value at Kiln
Minden Brick Co. ....	Minden..	700,000.....	\$ 6,300.00

THE MINDEN BRICK COMPANY, MINDEN

The one plant of Kearney County, The Minden Brick Company, was established in 1905. It was then transferred to C. E. Lockwood, who, in 1910, relinquished his ownership to Wunner & Gill. On September 1, 1912, it became the property of the present owners, Krewsen, Wight and Krewsen.

The plant consists of 6 buildings, and covers an area of 5 acres. Four down-draft kilns, each having a capacity of 90,000 brick, are used. These have a present working capacity of 360,000 brick. The clay pit covers 2 acres and is 15 feet deep. It consists of 13 feet of smooth-textured buff clay, containing iron and lime concretions, overlaid by 2 feet of black loam. The mixers and moulds are operated by an 80 horse power Frost steam engine. The brick are shed-dried, and are burned from 14 to 16 days. This requires 1,200 tons of coal, the average cost of which is \$3.35 a ton. This comes mostly from Cambria, Wyoming, with a small amount from Iowa. Fourteen men, receiving \$2.25 a day for their services, operate the plant. The annual output of brick, which are of the common red building variety, averages 700,000. Three grades are manufactured, retailing at \$7.50, \$8.50, and \$9.50 a thousand respectively. Only 250,000 brick were manufactured in 1911, and no brick at all were made this season. Approximately 25 per cent are marketed in Minden, the balance in nearby towns.

KEITH COUNTY

Name of Plant	Town	Output	Approx. Value at Kiln
Hodkinson Brick Plant....	Ogallala..	200,000.....	\$ 1,700.00

## NEBRASKA GEOLOGICAL SURVEY

## HODKINSON BRICK PLANT, OGALLALA

The one brick plant in Keith County, located at Ogallala, was organized in 1910 by William Hodkinson. The plant and pit together cover 2 acres. Two up-draft kilns of a capacity of 55,000 brick are used. The mixers and moulds are run by horse power. The brick are thoroughly sun-dried, and burned for 4 days. The labor of 6 men is required to operate the plant. Five of these laborers are the sons of the owner, the average wage being \$2.00 a day.

In operating the plant 80 tons of coal are shipped from Mendota, Iowa. The clay pit covers  $\frac{3}{4}$  of an acre and has 3 layers, the top and bottom layers being light clay, while the middle is a darker clay. The annual output is 200,000 common red building brick of a fair quality which retail at \$8.50 a thousand.

## KNOX COUNTY

Name of Plant	Town	Output	Approx. Value at Kiln
Bloomfield Brick Works	Bloomfield	400,000	\$3,200.00

## BLOOMFIELD BRICK WORKS, BLOOMFIELD

The Bloomfield Brick Works, the only one in Knox County, was established by Sherman Saunders, who later transferred it to Bloodheart & Grable, who, on November 1, 1910, sold it to the present owner, C. A. Brons. The plant covers 3 acres, and has 4 round kilns of a capacity of 50,000 brick each. The pit covers  $\frac{1}{2}$  acre and consists of 18 feet of yellow loess clay. The mixers and moulds are operated by a 53 horse power Fairbanks & Morse engine. The bricks, which are of the common red building variety, are shed-dried in racks and then burned for 11 days. It requires 9 men, receiving a daily wage of \$2.00, to operate the plant. To burn the brick, 250 tons of coal at \$5.00 a ton are used yearly. The annual output of the plant is 400,000 brick costing \$5.75 a thousand and retailing at \$8.00 a thousand.

The plant at Wausa has been abandoned and we were unable to secure information regarding it.

## LANCASTER COUNTY

There are 2 brick plants in Lancaster County, both of them important, namely the Yankee Hill Brick Manufacturing Company, located 5 miles southwest of Lincoln, and the Lincoln Brick Works at West Lincoln, about 1 mile west of Lincoln.

Name of Plant	Town	Output	Approx. Value at Kiln
Yankee Hill Brick Manufacturing Co.	Lincoln	8,000,000 common	\$ 68,000 00
		1,000,000 tile	5,500 00
Lincoln Brick Works	Lincoln	1,500,000 common	12,750 00
		8,500,000 tile	46,750 00
Totals		19,000,000	\$133,000.00

## YANKEE HILL BRICK MANUFACTURING COMPANY, LINCOLN

The Yankee Hill Brick Manufacturing Company was established about the year 1886 by Mr. Stockwell, who later transferred it to Mr. S. W. Burnham. In 1912 the property was again transferred, this time to Mr. W. H. Ferguson, who has a controlling interest in the plant.

The plant consists of 13 buildings and covers 8 acres. The pits alone cover 80 acres. A section shows a workable face of about 30 feet. There are 3 layers as follows: 5 to 10 feet of buff loess in places, 8 to 10 feet of reddish-buff glacial drift, and the balance consisting of blue and mottled clay of the Dakota formation.

In making brick the clays from the three layers are mixed, so there is no loss incident to stripping. The brick are steam dried and are burned for about 14 days. The mixers are run by steam. A 250 horse power Corliss engine is used to operate the machinery. There are 6 kilns, 3 continuous, 2 bee hive, and 1 Eudaley. The total capacity is 1,160,000 brick. The present working capacity of the kilns is 730,000 brick at each setting of the kilns. The plant employs about 40 men at an average daily wage of \$2.50. Sixteen hundred tons of kiln coal, costing \$4.00 a ton, are shipped annually from Rock Springs, Wyoming. The same amount of engine coal is consumed annually. This is shipped from southern Kansas at \$4.10 a ton. The annual output of brick is about 8,000,000, consisting of common building brick, rug or effect brick, and press brick. In addition, 1,000,000 hollow building tile are made annually. The brick retail at \$8.50 a thousand, and the tile at \$5.50 brick measure. The output is marketed in Lincoln and over the eastern portion of the State.

This is one of the most promising brick plants in Nebraska, because of the quality of the clay, its amount, and accessibility. Almost every grade and shade of brick can be produced at this plant.

#### THE LINCOLN BRICK WORKS, LINCOLN

This plant, located in West Lincoln, 1 mile due west of the city, was established by Mr. L. K. Holmes in 1882, and was transferred to Mr. C. Klose some 15 years ago. The entire plant covers 45 acres. There are 6 buildings, 3 of which are dwellings. The pit covers 25 acres and is 30 feet deep. A section shows it to consist of drift with some loess. Being very sandy, it is necessary to add some clay. Two-thirds of the clay used in tempering is hauled from an exposure of Dakota clay 1 mile west of the plant, and  $\frac{1}{3}$  from a Dakota clay bed 6 miles south of Lincoln.

The brick are air-dried and are burned for 8 days. The mixers and moulds are run by electricity. There are 2 continuous kilns in operation each having a capacity of 250,000 brick. Fifty men, at an average daily wage of \$2.50, are required to operate the plant. Six hundred tons of kiln coal, shipped from Rock Springs, Wyoming, at \$4.25 a ton, are used annually. No engine coal is required, since the machinery is run by electricity.

The annual output of this plant is 1,500,000 common red building brick and 8,500,000 hollow tile. The building brick retail at \$8.50 a thousand, while the building tile brings \$5.50 brick measure. Both the brick and building tile find a market in Lincoln and other parts of the State.

#### MADISON COUNTY

Name of Plant	Town	Output	Approx. Value at Kiln
Madison Brick Plant.....	Madison..	1,000,000.....	\$ 8,000.00

#### THE MADISON BRICK PLANT, MADISON

The Madison Brick Plant, the only one in the county, was established by its present owner, C. F. Kaul, in 1884. The plant covers 7 acres, and uses 3 kilns. Two of these have a capacity of 40,000 brick each, while the third has a capacity of 120,000. The clay pit covers 7 acres and averages 5 feet in depth. It consists of loess clay capped by a 2-foot layer of black loam. The sand used in tempering the brick is shipped from Columbus, Schuyler, and Norfolk. The mixers and moulds are run by steam, and the brick are shed-dried. Each year the plant uses 1,500 tons of coal costing \$4.50 a ton, and this is shipped from Rock Springs, Wyoming. Generally 9 men, at \$2.00 a day, are employed, but the number of laborers vary from 6 to 16.

The Company manufactures 2 varieties, fire brick and common red building brick. The Company has practically ceased manufacturing fire brick, which were made of clay secured at Louisville. These retailed at \$10.00 a thousand, but so far this season, none have been manufactured. The annual output of red building brick is 1,000,000 and these retail at \$8.00 a thousand.

## NEBRASKA GEOLOGICAL SURVEY

## NANCE COUNTY

There are 2 brick yards in Nance County, one at Fullerton and one at Genoa, but both are abandoned.

The brick yard at Fullerton was established in 1883 by Albert Hurley, who sold it to Mr. Edward Watts in 1901. Mr. Watts still owns the plant, although it has not been in operation since 1901.

The Genoa Brick Company was established by the Genoa Brick & Investment Company, Mr. Rose being the chief promoter. This Company sold the yard in 1908 to the Genoa Brick Company, whose stockholders are Messrs. C. R. Wright, John Allen, D. A. Willard, E. M. Spear, J. A. Osborn, William Ames, and G. A. Mollin. This plant discontinued operation in 1909 and is now being dismantled.

## NEMAHA COUNTY

Name of Plant	Town	Output	Approx. Value at Kiln
H. H. Horrum Brick & Tile Co. ....	Auburn..	162,000 common..... 137,000 hollow tile.....	\$ 1,215.00 3,000.00
Totals .....		299,000.....	\$ 4,215.00

## W. H. HORRUM BRICK &amp; TILE COMPANY, AUBURN

This plant, located about  $1\frac{1}{4}$  miles southeast of Auburn, is owned and operated by W. H. Horrum, who established it in the spring of 1905. The plant covers 4 acres and the clay pit, which covers 1 acre, is excavated to a depth of 10 to 15 feet in glacial drift.

There are 2 up-draft kilns, one having a capacity of 265,000 brick, the other 162,000. In addition, one down-draft kiln having a capacity of 15,000 drain tile is in use. The brick are dried in sheds 6 to 8 days, after which they are burned 12 to 14 days. Two kinds of brick are manufactured, common building and soft mud brick. More tile than brick are produced and an additional kiln is to be installed. The coal used is shipped from Wier, Kansas, and costs about \$3.45 a ton. The plant employs 8 to 12 men at an average wage of \$2.00 a day. The annual output of brick is 162,000, while that of drain tile is 137,000. The drain tile is marketed along the little Nemaha Valley and retails for \$15.00 to \$50.00 a thousand, according to size. The brick are marketed in this State at \$7.50 a thousand.

## NUCKOLLS COUNTY

Two brick plants are recorded for this county, although but one is in operation.

Name of Plant	Town	Output	Approx. Value at Kiln
Superior Brick Plant.....	Superior..	400,000.....	\$ 3,200.00

## SUPERIOR BRICK PLANT, SUPERIOR

The brick yard at Superior was established by Mr. Marshall, who sold the plant to its present owner, Mr. A. King, in 1909. Mr. Andrew Cordall operates the plant, which has an annual output of 400,000 common red building brick, retailing at \$7.50 a thousand for kiln runs, and \$9.00 a thousand for No. 1.

The plant and pit together cover 10 lots. Three down-draft kilns, having a capacity of 30,000 brick each, are used. The mixers and moulds are run by horse power; the bricks are shed-dried, and burned for 7 days. This requires the labor of 2 men receiving a daily wage of \$2.00. The annual output has averaged 400,000 brick, but during the years 1910 and 1911 only 290,000 brick were manufactured each year.



The clay pit is about 19 feet deep and a section shows: top, 1 foot of loam; second layer, 18 inches of dark brown clay; third, 4 feet of reddish clay; fourth, 5 feet of buff clay; and fifth, 6 feet of reddish buff clay. It has been learned that the clay supply has been exhausted, and the plant is to be dismantled.

The Nelson Brick Company was established at that place in 1890 by M. S. Stover, its present owner. The plant has been abandoned since 1906. When in operation it used one continuous and 2 down-draft kilns, manufacturing 500,000 brick annually.

## OTOE COUNTY

There are 2 brick plants in Otoe County, both at Nebraska City, the Bickel Brick Plant and the Nebraska City Brick Company.

Name of Plant	Town	Output	Approx. Value at Kiln
Bickel Brick Plant...	Nebraska City..	250,000.....	\$ 2,000.00
Neb. City Brick Co....	Nebraska City..	4,000,000.....	32,000.00
Totals .....		4,250,000.....	\$34,000.00

## THE BICKEL BRICK PLANT, NEBRASKA CITY

The Bickel Brick Plant, located one-eighth mile north of the Missouri Pacific Passenger Depot, was established by C. B. Bickel, and later transferred to his grandson, W. J. Bickel, who is the present owner. This plant, however, is not now in operation.

The clay used by this Company was principally loess. The mixers and moulds were run by horse power. The brick were first sun-dried, and then baked in a single kiln with a capacity of 80,000 brick. At a cost of \$6.00 a thousand, 250,000 common red building brick were manufactured annually, and sold for \$8.00 a thousand. Four men were employed at \$2.00 a day to operate the plant.

## THE NEBRASKA CITY BRICK COMPANY, NEBRASKA CITY

The Nebraska City Brick Company, owned by Mr. Charles A. Tramp, manufactures a good quality of brick of various colors. The brick are all made from the same clay, but are colored buff, red, or umber, according to treatment. The clay pit is on the Chicago, Burlington & Quincy Railroad tracks, about 150 yards south of the kilns. The blue shale, which is used in making the brick, is transported from the pit to the moulds by a small spur line. The Carboniferous clay bank is approximately 30 feet in thickness, and is over-capped by a 3-foot layer of limestone, topped by a 12-foot layer of drift.

The brick are first dried in sheds and then transferred to the kilns, which have a capacity of 60,000 brick each. The annual consumption of coal is 1,200 tons at \$4.00 a ton. Fifteen men, at a daily wage of \$2.00 a day, operate the plant, which manufactures 4,000,000 brick. These cost the Company \$6.00 a thousand, and retail at \$8.00 a thousand.

Since being transferred to Mr. A. H. Farrens about 3 years ago, the name of this plant has been changed to that of the Western Brick and Supply Company. It is one of the most highly organized and efficient brick plants in the State. The clay is from the Carboniferous formation and is obtained from the pit at the plant. The brick are dried by means of hot air and waste heat and steam from the plant. But 2 days are required for burning the hollow building tile. Six round, down-draft kilns are in use. Thirty men, paid by the piece, averaging about \$3.00 a day, are employed to operate the plant. The coal used comes from Illinois and costs about \$3.50 a ton. The annual output is 8,000,000 hollow tile, brick measure, retailing at \$5.50 a thousand. These building tile are of unusual quality. At one time this plant manufactured for the

Burlington roundhouses, brick of the variety called "pavers." These were of excellent quality. When subjected to the rattler test but 13.6% were worn away. A loss of 18% is counted a good brick. Apparently there are unusual possibilities in this clay for the manufacture of high grade pavers. The output of hollow tile is marketed in Iowa as far as Bedford, and throughout Nebraska.

## PAWNEE COUNTY

Name of Plant	Town	Output	Approx. Value at Kiln
Table Rock Brick & Clay Company	Table Rock	3,000,000	\$24,000.00

## TABLE ROCK BRICK &amp; CLAY COMPANY, TABLE ROCK

This Company has a 10-acre tract, extensively excavated. The thickness of clay exposed in the pit is 27 feet. They manufacture building brick exclusively, of which about 3,000,000 are produced annually. The kilns are continuous. Some 25 to 30 men find employment in this plant. It is reported that this plant is to be closed.

## TABLE ROCK BRICK YARD, NO. 2, TABLE ROCK

This plant had a capacity of 40,000 brick a day, but it has been closed since 1910. There are 12 bee hive kilns.

## THE AMERICAN BALLAST COMPANY, TABLE ROCK

This Company used to produce enormous amounts of gumbo ballast for the Burlington Railroad. Their capacity used to be as great as 300,000 yards of gumbo ballast a day. This extensive plant has not been in operation for several years.

## PHELPS COUNTY

Name of Plant	Town	Output	Approx. Value at Kiln
Western Brick and Supply Co.	Holdrege	3,500,000	\$25,000.00

## WESTERN BRICK AND SUPPLY COMPANY, HOLDREGE

There is but one brick company in Phelps county, that of the Western Brick and Supply Company, located at Holdrege. It was established in 1891 and later transferred to the Western Brick and Supply Company, G. L. Atwood being the present manager.

The plant and pit together cover 12 acres. There are 8 buildings besides a drier, and the kiln, which is of the up-draft type with a capacity of 22,000 brick. The clay pit is 18 feet deep and consists of 15 feet of coarse textured buff clay capped by 3 feet of black soil. The sand used in tempering the clay is obtained from Lowell, Cowles, and Brickton, Nebraska.

The mixers and moulds are operated by a 50 Erie horse power engine, which likewise operates the car which conveys the clay from the pit to the mixers. The brick are shed-dried with the aid of waste heat forced back by means of a 32 horse power gasoline engine, used for various other purposes, such as running the draft, fans, and so forth. The brick are burned for about 3 days. Each year the plant consumes 300 tons of kiln coal at \$3.50 a ton, from Sheridan, Wyoming, and 100 tons of engine coal at \$4.50 a ton, from Wier, Kansas. Twenty men, at \$2.25 a day, are given employment in the annual manufacture of 3,500,000 brick. These are of one variety, the common red building brick, and are marketed in Nebraska, mostly south of the Platte River, west of Holdrege, and along the Burlington lines in Kansas and Colorado.

## PLATTE COUNTY

There are 2 brick yards in Platte County, one at Humphrey, the Humphrey Steam Brick Yard, and one at Columbus, the Columbus Brick Plant.

Name of Plant	Town	Output	Approx. Value at Kiln
Humphrey Steam Brick Yard	Humphrey	1,000,000	\$ 8,500.00
Columbus Brick Plant	Columbus	2,000,000	14,000.00
Total		3,000,000	\$22,500.00

## HUMPHREY STEAM BRICK YARD, HUMPHREY

The Humphrey Steam Brick Yard was established by Mr. Peter Fedterson in 1887, who transferred it to Mr. Frank Lesh in 1902. In 1906, it came into the possession of the present owner, Mr. Fred Baumgart.

The plant, consisting of 14 buildings, covers 4 acres. There are 3 up-draft kilns of a capacity of 150,000 brick each. The mixers and moulds are operated by a Murray 40 horse power steam engine. The brick are shed-dried without hot air, and are burned for 10 days. This requires the services of 12 men, at a daily wage of \$2.00. The average annual output of 1,000,000 common red building brick requires the consumption of 500 tons of kiln coal and 150 tons of engine coal at \$4.25 a ton, purchased from Colorado, Wyoming, and Illinois. These retail at \$8.50 a thousand, and 75 per cent finds a market in Humphrey, while the rest are marketed in nearby towns. The clay pit is 20 feet deep, and covers 11 acres. A section shows it to consist of 3 layers, a capping of black over a yellow layer, and underneath this a lighter layer of loess clay.

## THE COLUMBUS BRICK PLANT, COLUMBUS

The Columbus Brick Plant, located 1 mile east of Columbus, was established by the Carrs-Nichols Company in 1903, and transferred by them to J. S. Nichols, the present owner.

The plant covers 7 acres, and uses 4 up-draft kilns of a capacity of 100,000 brick each, and 1 down-draft kiln with a capacity of 70,000 brick. These have a daily working capacity of 20,000 brick. The clay pit, covering 5 acres, is 30 feet deep. The clay now used is shipped from David City, Nebraska.

The mixers and moulds are run by a 25 horse power steam engine known as the Houston, Stawwood & Gamble. The brick are shed-dried and are burned for about 8 days. This requires 1,000 tons of coal, at an average cost of \$3.68 a ton, which is shipped from Centerville and Mendota, Iowa, and Unionville, Missouri. Twenty men, at \$2.00 a day, are employed. The annual output of the plant is 2,000,000 common red building brick of fair quality, which retail as follows: \$8.00 a thousand for selected; \$7.00 a thousand for No. 1; and \$5.00 a thousand for No. 2. Seventy-five per cent is marketed locally, the other 25 per cent finding a market in neighboring towns.

## POLK COUNTY

There is but one brick plant in Polk County, the Stromsburg Brick Company, organized in 1891 by Mr. John Olson, who sold it in 1893 to the Stromsburg Brick Company, with C. G. Berglund as manager.

Name of Plant	Town	Output	Approx. Value at Kiln
Stromsburg Brick Co.	Stromsburg	400,000	\$ 3,000.00

## STROMSBURG BRICK COMPANY, STROMSBURG

The plant and pit together cover 5 acres. There are 5 buildings, and the plant uses 2 up-draft open-top kilns with a capacity of 85,000 brick each. Their



daily working capacity is, however, about 80,000 brick a kiln. The clay pit is 18 feet deep and aside from 3 feet of buff clay is made up of about 15 feet of black loamy soil. The mixers and moulds are operated by a 12 horse power Fairbanks & Morse gasoline engine. The brick are shed-dried, and are then burned for 7 days. Ten men, at an average daily wage of \$2.00, are employed. Four hundred tons of Rock Springs, Wyoming, coal, costing \$7.50 a ton, are consumed in manufacturing 340,000 brick. The annual output of brick averages 400,000, but during the year 1911 only 160,000 were manufactured. The Stromsburg Brick Company has recently supplemented their plant with a cement block plant.

## RED WILLOW COUNTY

There are 2 brick yards recorded for Red Willow County, both at McCook, but one is not in operation at the present time.

Name of Plant	Town	Output	Value at Kiln
McCook Brick Co.....	McCook..	1,000,000.....	Approx. \$ 7,000.00

## M'COOK BRICK COMPANY, M'COOK

The McCook Brick Company, organized with Mr. James McAdams as president, R. A. Green, secretary and treasurer, V. Franklin, and the Minard estate, established in 1902 a plant 1 mile west of McCook. The plant, comprising 6 buildings, covers 5 acres.

The clay pit at the plant covers  $\frac{1}{2}$  an acre, is 25 feet deep, and shows 2 strata, namely, a black soil layer, overcapping a layer of very fine buff, alluvial clay. About 10 per cent of shale, brought from the Company's pit 2 or 3 miles distant, is ground with a Raymond Dry Pan, and mixed with common clay. The mixers, moulds, and other machinery are operated by a 65 horse power Chandler & Taylor steam engine, with 2 boilers of 35 and 60 horse power respectively. The brick are shed-dried with the aid of hot air, and are burned for 5 days in 3 up-right kilns, fully equipped with a base burning system and having a daily working capacity of 750,000 brick. This requires the labor of 15 men at \$2.25 a day.

The plant consumes during the year 650 tons of Wyoming and Colorado coal at an average cost of \$5.00 a ton. The average annual output is 1,000,000 common red building brick which retail in car load lots at \$7.00 a thousand, or \$8.00 a thousand for No. 1 and \$7.00 a thousand for kiln run. The plant was operated only a part of 1911, and during that year but 750,000 brick were manufactured, 40 per cent of which was marketed in Nebraska, and 60 per cent in Colorado.

## THE M'COOK PRESS BRICK COMPANY, M'COOK

This Company was incorporated with 15 stockholders, among whom Patrick Welsh, Harry Bucherest, J. E. Kelly, and W. T. Weeks were prominent. This Company has now been dissolved as a corporation, and the plant has been sold. It was established in 1906,  $\frac{1}{2}$  mile east of McCook, but on account of insufficient brick material, it was abandoned in 1909.

The plant consisted of 2 buildings, and covered 2 acres. The clay pit covered  $\frac{1}{2}$  acre, was 8 feet deep, and composed of a layer of black loam over a layer of yellow arenaceous clay. When in operation there were 2 open kilns, each having a capacity of 320,000 brick. The mixers and moulds were operated by a 25 horse power steam engine. The brick were dry-pressed and smoked, after which they were burned for 14 days. This required the services of 8 men, receiving a daily wage of \$2.50. The coal was obtained from Centerville, Iowa, and cost on an average, \$5.00 a ton. Pressed brick were manufactured, and retailed locally for \$8.00 a thousand.



## RICHARDSON COUNTY

Name of Plant	Town	Output	Approx. Value at Kiln
Humboldt Brick Co.....	Humboldt..	3,000,000.....	\$ 2,400.00

## THE HUMBOLDT BRICK COMPANY, HUMBOLDT

The plant of this Company, located about ½ mile west of Humboldt, was established in February, 1906, and has become one of the best known plants in the State. The daily capacity is 50,000 brick on a 10-hour run. There are 12 continuous kilns with a capacity of 60,000 brick to the kiln. The plant employs 25 to 30 men. The plant manufactures brick for foundations, building, and paving. About ⅓ of the output is paving brick, sold mainly to the Burlington Railroad. The market is southeastern Nebraska and northeastern Kansas. The brick range from \$6.00 for building brick to \$9.00 for paving brick. The bed of Carboniferous shale, from which this brick is made, has an exposed thickness of about 30 feet. The plant is in operation during the summer months only.

## SALINE COUNTY

Four brick plants are recorded for Saline County. Although they produced and marketed many brick, 3 of these plants have been abandoned since 1910.

Name of Plant	Town	Output	Approx. Value at Kiln
Dhooge Brick Co. ....	Crete..	200,000.....	\$ 1,400.00

## THE DHOOGЕ BRICK COMPANY, CRETE

The Dhooge Brick Company was started in 1911 by Gus Dhooge. The plant, including the clay pit, covers 2 acres, and the pit consists of 5 feet of loamy soil. A single clay mixer is run by horse power. The brick are shed-dried, and burned for 7 days in a single up-draft kiln, which is merely 2 brick walls roofed over, but in which from 400,000 to 800,000 brick can be burned at a time. Six men are employed to operate the plant at a daily wage of \$2.00. Eighty-five cords of wood, at \$6.00 a cord, are consumed in producing 200,000 brick. In 1911, the first year the plant was in operation, about 200,000 common red building brick were made.

August Dhooge, Sr., established a brick yard at Crete in 1890 and operated it until 1910. The approximate annual output was 800,000 brick.

Jacob Lanham also operated a small plant in Crete at one time, but it has not been in operation since 1890.

## KENNEY BRICK YARD, DORCHESTER

The Kenney Brick Yard was established by Frank Kenney, 3 miles north-east of Dorchester. It has been abandoned because too far from market. The plant consisted of 4 buildings and covered 2 acres. The clay pit is 6 feet deep and has a black and buff layer.

The brick were shed-dried, and were burned in a clamp kiln of a capacity of 140,000 brick. The burning and water-smoking required 7 to 8 days. Five men were employed, receiving \$1.50 and their board as daily wage. The brick manufactured were of the common building type, and retailed at \$7.50 a thousand. No other data respecting the annual output was available.

## SARPY COUNTY

Sarpy County boasts of one of the largest brick yards in Nebraska. This is located at Avery, a suburb 8 miles south of Omaha, and ranks first in value and second in production.

Name of Plant	Town	Output	Approx. Value at Kiln
Hydraulic Press Brick Co. ....	Avery	11,000,000	\$220,000.00

## HYDRAULIC PRESS BRICK COMPANY, AVERY

This company, at Avery, 8 miles south of Omaha, was organized with the following officers in St. Louis: George A. Bass, president; Ralph Simpkins, vice-president and secretary; F. N. Miles, general manager; and R. W. Besley of Omaha, manager of the Omaha branch. The main office of the Company is at St. Louis, Missouri, while the Omaha branch has an office in the Woodmen of the World building.

The Omaha branch of the Hydraulic Press Brick Plant is extensive, covering approximately 20 acres. Ten down-draft kilns, each having a capacity of 120,000 brick are worked to their full capacity. The clay pit covers 40 acres, varies from 3 to 35 feet in depth, and consists of 2 layers, a red, and a buff sandy clay layer. Below this the clay is usually in pockets. Only a little of the clay from the pit near the plant is used, and the brick made from it are of a red color. Most of the clay used by the plant is shipped from Louisville.

The mixers and moulds are operated by steam and hydraulic pressure respectively. The surplus heat from the kilns is transported, by means of large pipes, back to the drying sheds, where it is utilized in drying freshly-made brick. The brick are then burned from 5 to 6 days. Three steam engines are used, 2 of 45 horse power, and 1 of 70 horse power, with boilers of the same strength. To operate the plant, the services of 65 to 70 men, paid at the rate of 25 cents an hour, are required. Seventy-five hundred tons of kiln coal, some from Iowa, but mostly secured through Omaha dealers, and 2,300 tons of engine coal from Iowa and Missouri, are purchased at \$2.60 a ton, and consumed by this plant each year.

The annual output ranges from 10,000,000 to 12,000,000 brick. These are manufactured in about 500 different shapes, and in a great variety of colors, such as light, medium, and dark gray, buff, light and dark red, light and dark manganese spot, and iron spot. Iron scales are dusted on the unburned brick and then subjected to 3,000° Fahrenheit, the iron fuses and brings out the spots. On cooling the brick have a glossy appearance as though glazed. By this process they are rendered practically non-absorbent. These brick retail at \$18.00 to \$24.00 per thousand for standard, and \$40.00 to \$235.00 a thousand for fancy. The market is in Iowa, Nebraska, South Dakota, Missouri, Wyoming, Montana, and as far west as the Pacific Coast.

## SCOTTS BLUFF COUNTY

There are 3 plants reported from this County.

Name of Plant	Town	Output	Approx. Value at Kiln
Gering Brick Co.....	Gering.....	600,000.....	\$ 5,400.00
Dooley Brick Plant.....	Scottsbluff..	1,200,000.....	\$ 8,400.00
Stearns Brick Plant.....	McGrue.....	500,000.....	4,500.00
Total .....		2,300,000.....	\$18,300.00

## GERING BRICK COMPANY, GERING

The Gering Brick Company established a plant in Gering in 1910. The plant itself covers  $4\frac{1}{4}$  acres, the clay pit  $\frac{3}{4}$  of an acre, and is about 7 feet deep. A section of the clay pit gives the following: 2 feet of light, gray-colored, slightly sandy top soil; 2 feet of darker colored, rough and plastic clay; 3 feet of light colored material, known locally as "flour" clay. The clay is chiefly Brule and alluvium.



The mixers and moulds are operated by horse power. The brick are shed-dried with the use of hot air. The brick are then water-smoked from 9 to 11 days, and  $3\frac{1}{2}$  to 4 days are required for burning in an up-draft kiln with a capacity of 230,000 brick. Two hundred and forty tons of coal, costing \$5.25 a ton, used by the plant, are shipped from Sheridan and Dietz, Wyoming. Nine men at a daily wage of \$2.27 operate the plant. The plant manufactures 600,000 common red building brick annually, retailing at \$9.00 a thousand at the plant, and marketed throughout the North Platte Valley.

## DOOLEY BRICK PLANT, SCOTTSBLUFF

In 1906 a brick yard was established on the Platte River, 1 mile southwest of Scottsbluff, by Charles E. Dooley, who still owns the plant.

It is reported to this office that the average annual output of the plant is about 1,200,000 brick. Mr. Dooley informs us that only 400,000 brick were manufactured in 1912, and none in 1913. The pit, 30 feet deep, consists of alluvium and Brule clays. The plant covers 2 acres, and the clay pit consists of 15 feet of yellow clay. No stationary kilns are used. The brick are simply made up in piles of 2,000 or 3,000 brick, and a casing built around them. After the brick are burned, this casing is torn down. The coal used comes from Sheridan and Dietz, Wyoming, and about 500 tons, at \$5.50 a ton, are consumed annually. Ten men, at \$2.25 a day, are employed.

## STEARNS BRICK PLANT, M'GRUE

A small brick plant was established in 1911 at McGrue, 8 miles south of Minatare, by Frank Stearns, the present owner. This plant has now been abandoned. The brick manufactured by this plant were first sun-dried, and then burned in 2 up-draft kilns each having a capacity of 75,000 brick. This required the labor of 8 men, receiving a daily wage of \$2.25. Sixty tons of Maitland, Colorado, coal were consumed by the plant each year. During 1911 the owner expected to manufacture 500,000 common red building brick with a retail price of \$9.00 a thousand, delivered within one mile of the plant.

## SEWARD BRICK WORKS, SEWARD

Name of Plant	Town	Output	Approx. Value at Kiln
Seward Brick Works	Seward	3,000,000	\$22,500.00

## SEWARD BRICK WORKS, SEWARD

The Seward Brick Works, the only one in this county, was established by William Worthman, Senior, at Seward, Nebraska. The plant was later transferred to the present joint owners, George F. Cotton and William Worthman, Junior. The plant covers  $8\frac{1}{2}$  acres, and the clay pit is 35 feet deep, covering  $1\frac{1}{2}$  acres. The top 18 feet consists of buff clay tinged with red, and underneath this is a stratum of sand.

The mixers, moulds, drafts, and other machinery, are operated by a 65 horse power steam engine with an 80 horse power boiler. The brick are shed-dried and then burned for 12 days in one continuous kiln with a capacity of 300,000 brick. The daily kiln capacity of this plant is 10,000 brick, while the machinery capacity is 36,000. When the plant is in full operation, 22 men are employed at an average earning of \$2.75 a day, but only six are engaged steadily. Three hundred tons of coal are consumed in making 600,000 brick, and 5 per cent less proportionately in making 3,000,000 brick. Twenty-five per cent of the kiln coal is purchased from Rock Springs, Wyoming, and 75 per cent from Sheridan, Wyoming, at an average cost of \$3.20 a ton.

The average annual output of this plant has been 3,000,000 brick, but during 1911, only 650,000 brick were manufactured. These retail at \$8.50 a thousand for No. 1, and \$7.50 a thousand for kiln run. The brick are marketed in Seward and vicinity.

## SHERMAN COUNTY

The Henry Ohlsen Brick Manufacturing Company is located 6 blocks south of Loup City. It was established by Ohlsen & Schmidt in 1888, and transferred by them to Henry Ohlsen. It again changed hands and came into the possession of Henry and John Ohlsen. In 1911 it again became the property of Henry Ohlsen, who is its present owner.

Name of Plant	Town	Output	Approx. Value at Kiln
Ohlsen Brick Mfg. Co.	Loup City	1,700,000	\$15,300.00

## THE OHLSEN BRICK MANUFACTURING COMPANY, LOUP CITY

The plant and pit together cover 20 acres. The plant has 12 buildings and 2 continuous kilns of a capacity of 100,000 brick each, and with a present working capacity of 12,000 brick daily. The yard is located in the Loup Valley, so they use valley clay. The clay pit is 6 feet deep and a section gives a black earth surface, clay, and sand.

The mixers, moulds, and other machinery are operated by a Foos 50 horse power gasoline engine. The brick are dried in racks before being burned. Two hundred and fifty tons of Sheridan and Rock Springs, Wyoming, coal, costing the Company about \$4.50 a ton, are consumed each year. Eighteen men, at an average wage of \$2.25, are employed to operate the plant. The annual output of building brick, which are of a cherry red color, is 1,700,000, retailing for \$9.00 a thousand.

## STANTON COUNTY

The Stanton Brick Yard, the only brick plant in Stanton County, was established by its present owner, Carl Strahle, in 1904,  $\frac{1}{4}$  mile west of Stanton.

Name of Plant	Town	Output	Approx. Value at Kiln
Stanton Brick Yard	Stanton	1,500,000	\$12,000.00

## STANTON BRICK YARD, STANTON

The plant covers  $2\frac{1}{2}$  acres, and the pit covers 1 acre and is 20 feet deep. A section of the clay pit gives the following: 1 to 3 feet of black soil at the top; 3 to 12 feet of buff clay; 2 feet bluish gray clay;  $2\frac{1}{2}$  feet of dark brown soil; and red clay of unknown depth.

The owners of this yard dug down 35 feet into the bottom layer of red clay in search of sand, but found none, the clay becoming harder the greater the depth. In some places this red layer is within 6 feet of the surface, and at these points a 1-foot layer of dark brown soil underlies it. This contains no lime concretions, only a few quartz pebbles. The clay is fine grained, and in order to make good tile, some sand is mixed with it. A number of fossil bones have been found in the bluish-gray clay stratum. All the clay used by the plant is taken from their pit.

The mixers and moulds are operated by a Fairbanks-Morse 12 horse power gasoline engine. The brick are shed-dried, and are burned for 8 days. An up-draft kiln of a capacity of 90,000 brick, and a down-draft kiln with a capacity of 70,000 brick, are worked to their full capacity. Eight men at \$2.25 a day are employed to operate the plant. Three hundred and fifty tons of coal, at an average cost of \$4.65 a ton, are used each year. The coal is shipped from Franklin County, Illinois, and from Saylor, Iowa; the lignite from Lost Cabin and Hudson, Wyoming, and from Colorado. The annual output of this plant is 1,000,000 common red building brick, and about 500,000 round and square tile, which retail locally at an average price of \$8.00 a thousand.



## THAYER COUNTY

In 1901, Mr. L. Neville established the only brick plant in this County, about  $\frac{1}{4}$  of a mile from Hebron, and in 1908 transferred it to Mr. L. Dutcher, the present owner.

Name of Plant	Town	Output	Approx. Value at Kiln
Hebron Brick Plant.....	Hebron..	100,000.....	\$ 800.00

## HEBRON BRICK PLANT, HEBRON

The plant has 10 buildings, and the pit is 5 feet deep, showing reddish clay with about 18 inches of sand. About  $\frac{1}{8}$  sand is used in the brick mixture. The brick are shed-dried, and then burned for 10 days in 2 up-draft kilns having a capacity of 50,000 and 60,000 brick respectively, with a daily capacity of 20,000. Sixty tons of coal, at \$4.50 a ton, are shipped from Acme, Wyoming, and consumed annually by the plant. The labor of 4 men, receiving a daily wage of \$2.00, is required to operate the plant. The annual output is 100,000 common red brick, which retail for \$8.00 a thousand in a local market.

## DESHLER BRICK PLANT, DESHLER

The brick yard at Deshler is owned by Edward J. Cannon, but has not been in operation this season. We were unable to secure information concerning it.

## VALLEY COUNTY

The Ord Brick and Cement Works, the one plant in Valley County, was established by Svoboda and Gruber in 1899 at Ord, Nebraska. It was transferred to its present owner, E. W. Gruber.

Name of Plant	Town	Output	Approx. Value at Kiln
Ord Brick and Cement Works .....	Ord...	400,000.....	\$ 3,200.00

## ORD BRICK AND CEMENT WORKS, ORD

The plant consists of 5 buildings and covers  $4\frac{1}{4}$  acres. The clay pit covers  $\frac{3}{4}$  of an acre, and is about 20 feet deep. A section gives 10 strata as follows: 6 feet of black loam; 1 foot of buff clay; 20 inches of black loam; 3 feet of buff clay; 30 inches of dark clay; 1 foot of dark buff clay streaked with lime; 3 feet of buff clay; 10 inches of dark buff clay streaked with lime; 8 inches of buff clay streaked with lime; and very dark bluish clay.

The mixers and moulds are run by a 20 horse power Fremont gasoline engine. The brick are shed-dried, and are then burned for 12 days in a continuous kiln having a capacity of 80,000 brick. This requires the labor of 6 men, receiving a daily wage of \$2.00. One hundred and fifty tons of coal at \$4.50 a ton, are shipped from Sheridan and Rock Springs, Wyoming, and are consumed annually by the plant. During 1911, 868 gallons of gasoline, at 18 $\frac{3}{4}$  cents a gallon, were used in running the engine. The annual output is 400,000 common red building brick which retail for \$8.00 a thousand at Ord and Burwell.

## WASHINGTON COUNTY

There are 2 brick plants in this County, one at Arlington and one at Blair.

Name of Plant	Town	Output	Approx. Value at Kiln
Arlington Brick Yard....	Arlington..	500,000.....	\$ 4,000.00
Blair Brick Yard.....	Blair.....	240,000.....	1,440.00
Total .....		740,000.....	\$ 5,440.00

## NEBRASKA GEOLOGICAL SURVEY

## ARLINGTON BRICK YARD, ARLINGTON

In 1881, Ludwig and Hanscouer established the Arlington Brick Yard northwest of Arlington. The yard was later transferred to Barney Yungblut, and is now the property of Fred Brinkmann.

The plant consists of 3 buildings and covers 1 acre. The clay pit covers 2 acres, and consists of 15 to 30 feet of yellow buff loess clay. The mixers and moulds are operated by a 16 horse power Fremont Foundry gasoline engine. The brick are shed-dried, and are then burned in a round kiln having a capacity of 50,000 brick. For this purpose 50 cords of wood, at \$3.00 a cord, are used. One hundred and sixty tons of coal, at \$3.50 a ton, are shipped from Illinois yearly for use with the engine. Four men are employed and receive a daily wage of \$1.80. The average output of this yard is 500,000 common red building brick, retailing at \$8.00 a thousand.

## BLAIR BRICK YARD, BLAIR

Mr. J. H. Rhodes established the brick yard at Blair, and is its present owner. The plant, including the clay pit, covers about 3 acres. The pit itself covers about 1 acre, and is 13 feet deep, consisting of 3 feet of black loam; 2 feet of yellow clay; and 8 feet of yellowish blue clay, probably glacial. The cut from top to bottom is spotted with many small iron concretions.

The 2 clay mixers are run by means of horses, and the brick are sun-dried before baking. This is done in one large kiln, which is partitioned in the center, each part holding 120,000 brick. This requires the labor of 8 men, receiving a daily wage of \$1.75. About 70 tons of coal and 25 tons of coke are used in baking 240,000 brick, which is the average annual output. These are common red building brick.

## WAYNE COUNTY

There is but one brick plant reported in Wayne County, that of the Wayne Brick and Tile Works, established by its present owner, John F. Shirbahn, in 1882.

Name of Plant	Town	Output	Approx. Value at Kiln
Wayne Brick and Tile Works	Wayne	2,000,000	\$16,000.00

## WAYNE BRICK AND TILE WORKS, WAYNE

The plant has 5 buildings and covers 3 acres. One Conley and Wolf kiln of a capacity of 450,000 brick is used. The clay pit covers 5 acres, is 20 feet in depth, and 150 feet long. It is composed entirely of yellow drift clay, interspersed with patches of black loam. A 50 horse power common slide engine is used to operate the mixers and moulds. The brick are dried in open sheds, and then burned for 70 hours. This requires the labor of 10 men, who receive a daily wage of \$2.50. Two hundred and fifty tons of engine coal at \$6.00 a ton are purchased each year from Illinois.

The annual output of common red building brick is 2,000,000, costing \$5 00 a thousand, and retailing in Wayne and vicinity for \$8.00 a thousand. This plant also manufactures about 10,000 tile annually.

## WEBSTER COUNTY

Webster County at one time boasted 2 brick plants, one located at Rosemont, the other at Guide Rock. At present, however, only the one at Rosemont is in operation.

Name of Plant	Town	Output	Approx. Value at Kiln
Rosemont Brick Plant	Rosemont	800,000	\$ 8,000.00

## ROSEMONT BRICK PLANT, ROSEMONT

The Rosemont Brick Company, ½ mile east of Rosemont, was established by Horm Rose in 1911. The plant, consisting of 4 buildings, covered, together with the pit, 6 acres. A section at the pit shows 2 feet of loam above and 8 feet of coarse buff clay containing scattered patches of red clay, below.

The mixers, moulds, and other machinery are operated by a 100 horse power engine with 120 horse power boiler. The brick are shed-dried, and the burning and water-smoking require 10 days. Four up-draft kilns of a capacity of 300,000 brick are used. The services of 12 men, receiving an average daily wages of \$2.00 are required. Four hundred tons of coal, obtained from Iowa at a cost of \$3.38 a ton, are required each year. The annual output of the plant is 800,000 common red building brick which retail at \$10.00 a thousand, and are marketed locally along the Chicago, Burlington and Quincy Railroad.

## YORK COUNTY

There is but one plant in this County.

Name of Plant	Town	Output	Approx. Value at Kiln
York Brick and Tile Co....	York....	3,000,000.....	\$24,000.00

## YORK BRICK AND TILE COMPANY, YORK

The Company was established in York in 1914. The plant and pit together cover 6 acres. The pit is 50 feet in depth, and a section shows the following: 2 feet of black loam, yellow buff clay of medium texture, black soil mixed with coarse sand; 6 inches of black soil, coarse sand, and buff clay containing lime concretions all blended together; 10 feet of buff clay with lime concretions; 1 foot of green clay; and 16 feet of sand in layers varying from coarse to fine, and showing considerable cross-bedding. Some of this sand is used in making the brick.

One continuous kiln of a capacity of 300 brick is used. The mixers and moulds are operated by a 75 horse power steam engine, while a small gasoline engine is used for pumping water. The brick are shed-dried with the waste steam from the engine, and are then burned for 2 days. This requires the services of 25 men, who receive a daily wage of \$2.15. Six hundred tons of coal are used each year. The kiln coal is obtained from Rock Springs, Wyoming, for \$4.75 a ton, the engine coal is shipped from Avery and Oskaloosa, Iowa, and costs \$3.30 a ton.

The annual output of the plant is 3,000,000 common red building brick, which retail at \$9.00 a thousand for No. 1; \$8.00 a thousand for No. 2, and \$7.50 a thousand for kiln run. Fifty per cent of the output is marketed at York, the balance in nearby towns.

## SUMMARY

From the above it is apparent that some 40 counties are engaged in developing the clay industry of the State, that some 55 plants are in active operation, that the annual output of brick is 154,739,000, selling at \$1,330,205.00. Accordingly, Nebraska, which hitherto has ranked 27th in the clay production of the United States, now ranks 23rd. Between 1100 and 1200 men find employment at an average daily wage of \$2.25. The lowest wage paid is \$1.80 with board, the highest \$3.00.

The industry, though well begun, is capable of great future development. The symmetrical development of a state depends upon the best use of every resource.

The University of Nebraska.

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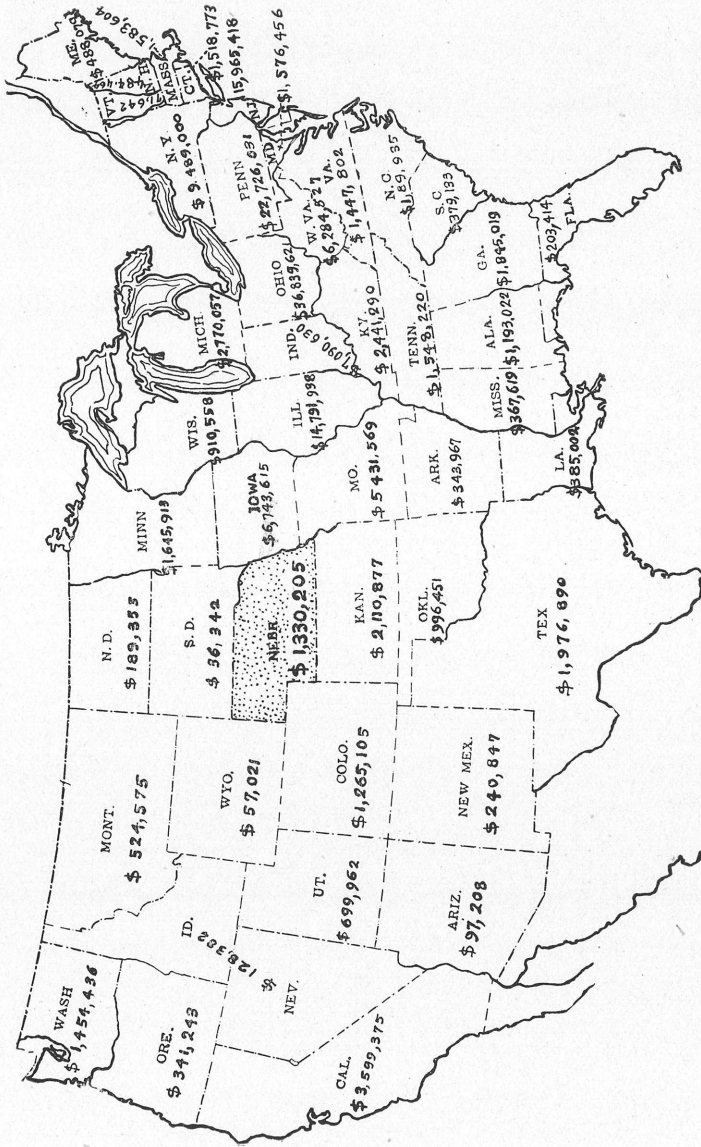


Fig. 2.—Sketch map of the United States showing the value of the clay industry in the several states. The total output for Nebraska is about \$1,330,205. Nebraska now ranks about 23d in total clay production.