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STOCKTON AND STANLEY HILL CLAY DEPOSITS

KOOTENAI COUNTY, IDAHO

By

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ABSTRACT

The Stockton and Stanley Hill deposits, Kootenai County, Idaho, are about 25 to 30 miles east of Spokane, Wash. During World War II, the areas were studied by the U. S. Geological Survey in cooperation with the U. S. Bureau of Mines. The Bureau of Mines hand-augered 162 holes and made chemical analyses of the samples for available alumina, and available ferric oxide, and measured the ignition loss.

The deposit contains two types of clay: granite residual clay derived from the weathering of Cretaceous granite gneiss in place; and transported clays of the Latah formation derived from the weathered debris of the granodiorite and older rocks.

The Stockton deposits average more than 20 percent available alumina and less than 10 percent available ferric oxide. The deposits, therefore, could serve as a small source of low-grade high alumina clay.

Clays containing more than 15 percent available alumina and less than 5 percent available ferric oxide would be suitable for many ceramic products and some may meet the requirements for high-heat or super-heat duties. Therefore, the Stockton and Stanley Hill clay deposits contain ceramic-grade clays.

INTRODUCTION

Purpose and Location

During World War II, the U. S. Geological Survey, in cooperation with the U. S. Bureau of Mines, made an appraisal of the national alumina resources in an attempt to guarantee an adequate supply of aluminum. This report is a part of a study of high-alumina clay near Coeur d'Alene, Idaho.

The Stockton clay deposits are in secs. 8, 9, 15, and 16, T. 50 N., R. 4 W., Boise meridian, Kootenai County, Idaho (fig. 1), about 2 to 3 miles northeast of the town of Coeur d'Alene. U. S. Highway No. 95, and a gravel road border the deposits on three sides. Approximately half a mile north of the deposits, the Northern Pacific Railroad connects the area with Spokane, Wash., 25 miles to the west. Power is available from a 22,000-volt transmission line from the Washington Water Power Co.

The deposit is on the margin of the Columbia River Plateau physiographic province that is characterized by broad, gently rounded hills and fairly broad, even-floored valleys. Altitudes range from 2,400 to about 2,510 feet; however, local relief seldom exceeds 50 feet. Parts of the area are covered with glacial debris. The area is drained by the Spokane River and its tributaries.

Field Work and Acknowledgments

The author examined and sampled some of the clay outcrops in the Stockton area, during the summer of 1938, as part of a study of clay in northern Idaho for the Idaho Bureau of Mines and Geology. An exploratory drilling program was conducted in the winter of 1942 by the U. S. Bureau of Mines, under the supervision of S. H. Lorain, District Engineer, and W. W. Featherstone, Project Engineer. One hundred and sixty-two hand auger holes were drilled totaling approximately 1,590 feet, and chemical assays were made on samples representing about 530 feet. In cooperation with the U. S. Bureau of Mines, the U. S. Geological Survey asked the author to conduct the drill hole logging and the geologic studies of the deposit during the summer and fall of 1942 and the fall of 1943.

The author is indebted to Mr. Lorain and Mr. Featherstone, U. S. Bureau of Mines, for the many courtesies extended and for the chemical data they made available. Mr. A. W. Fahrenwald, Director, Idaho Bureau of Mines and Geology, kindly gave permission to use the unpublished ceramic and field data obtained by the author in 1938. The writer is indebted to the University of Idaho for the use of office space while preparing portions of the report.

STOCKTON CLAY DEPOSIT

Geology

Regional Geology

The high-alumina clays of Washington and Idaho are divided into three types; residual clay derived by weathering of granitic rocks, residual clay derived by weathering of basaltic rocks, and transported clay. The transported clays are derived primarily from granitic residual clays that have been transported and deposited in water with other materials to form the Latah formation.

An understanding of the clay deposits is best obtained by a brief summary of the regional geology. The Belt series of pre-Cambrian age, consisting of quartzites, mica schists, and minor amounts of gneisses, form the mountainous country to the east and north of the clay district. Locally, upon the eroded surface of the Belt rocks, a series of volcanic flows were extruded in Permian(?) time. In late Jurassic or early Cretaceous time, the older rocks were cut by large masses of granite gneiss and related igneous rocks that are tentatively considered to be a part of the Idaho batholith. The typical granite gneiss is light gray, banded, strongly foliated, and at places slightly porphyritic. The visible minerals are feldspar, quartz, biotite, muscovite, and sphene. In many places, relict sedimentary structures were observed. According to Anderson (1940, p. 17) the granite gneiss was formed by the invasion of the Nelson batholith into quartzites of the Belt series.

Beginning in Miocene time, the Columbia River basalts were extruded (Pardee and Bryan, 1926, p. 11-12). These basalts are composed of plagioclase and augite in a glassy groundmass with minor amounts of ilmenite and olivine. Streams dammed by lavas formed lakes in which the Latah formation was deposited (Pardee and Bryan, 1926, p. 8). Thus the Latah formation is interbedded with and contemporaneous with the basalt.

During a protracted lull in the extrusion of basalt, a weathering surface developed in eastern Washington and northwestern Idaho. This weathering surface, which divides the upper basalts from the lower basalts, was given the name Excelsior surface (Scheid, 1946, p. 19). During the Excelsior interval, the climate was very warm and humid, with conditions that permitted complete oxidation and the formation of residual clays. The greatest thickness of residual clays was formed upon a land surface of low to moderate relief. The results of other intraflow weathering intervals have been observed, but none approaches the 124-foot maximum depth of weathering or the lateral extent of the Excelsior surface (Scheid, 1947, p. 1224). From drill hole data the Excelsior surface is known to be a gently undulating surface beneath the hills and does not rise far above the present valley floors.

Renewed extrusion of basalt brought the Excelsior weathering interval to an end. The upper Latah formation was deposited upon the granitic and basaltic residual clay in lakes that were formed by streams dammed by the post-Excelsior basalt flows. This member contains the principal transported clay deposits, and is now thickest beneath the hills. The Latah formation is composed of lacustrine and stream deposits of interbedded clays, sands, and gravels that were derived primarily from granitic and metamorphic rocks of the mountainous area.

During Pleistocene time, glaciers were present in the area at two different stages. The older or Spokane stage of glaciation is represented by terrace deposits and channel fill. Rocks of all sizes observed in the older glacial deposits include vein quartz, pegmatite, granite, basalt, slate, argillite, quartzite, schist, and gneiss. The younger glacial deposits are probably Wisconsin in age, and they are confined to elevations below the older glacial deposits. These younger glacial deposits are composed of outwash and reworked material from the older glacial material plus a large amount of black basalt sand and gravel. These deposits vary in thickness from a few inches to more than 20 feet.

Bog deposits of Quaternary age and landslide, talus, and alluvial materials of Recent age are present throughout the area.

Geology of the Stockton Clay Deposits

The Selkirk Mountains extend southward from Canada along the Washington-Idaho border. The Spokane River transects the southern end of these mountains, creating an isolated group of hills that extend from Spokane to Coeur d'Alene. Mica Peak, elevation 5,250 feet, is the highest point of these hills. The Stockton clay deposits are 8 miles northeast of Mica Peak on the south slope of a foothill.

The Stockton clay deposits are on a terrace underlain by Columbia River basalt and sediments of the Latah formation, and about 300 feet above the Spokane River. The terrace is bounded on the north by Recent landslides and talus deposits, on the east and southeast by glacial deposits, and on the south and west by hills of granite gneiss (pl. 1). The granite gneiss trends northwest and is cut by the Spokane River less than a mile west of the mapped area.

Rocks of the Belt series do not occur within the area of detailed mapping (pl. 1). These rocks have contributed very little except quartz and muscovite to the sedimentary beds of the Latah formation.

The Cretaceous granite gneiss is exposed along the south and west margins of the mapped area and at the edge of the Spokane River in the northeastern portion of the area (pl. 1). Debris from the granite gneiss is considered to be the source of most of the sediments of the Latah formation.

The Columbia River basalts form the floor of part of the embayment. On plate 1, both the upper and lower members of the Columbia River basalt are shown because they occur at different altitudes and the Latah formation lies between them. The lower basalts are exposed along the Spokane River and Coeur d'Alene Lake. The upper basalts form a relatively flat ridge from the central west portion to the southeast portion of the area (pl. 1).

Plate 1. Topographic and geologic map, Stockton clay deposits, Kootenai County, Idaho.

The Latah formation occurs throughout the mapped area, but seldom crops out (pl. 2). From drill hole evidence, the upper member of the

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Plate 2. Geologic sections, Stockton clay deposits, Kootenai County, Idaho.

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formation seems to be of a uniform thickness over a considerable extent. The best exposures of the upper member are in the valley along the contact between the granite gneiss and the upper basalts. Smaller exposures occur in the north central portion of the mapped area (pl. 1). Areas underlain by the upper Latah formation were identified by numerous pieces of sand cemented by iron oxides mixed in the soil.

The older glacial deposits occur as terraces along the western edge and as channel fill throughout the central portion of the mapped area (pl. 1). Most of these deposits occur at 2,400 to 2,450 feet in altitude. The younger glacial deposits cover a basalt terrace in the northwest corner of the mapped area and form a terrace between the Spokane River and the landslide-talus deposit area (pl. 2). Locally these deposits contain lenses of gray and blue, silty clay.

The bog deposits are impure peat deposits partly filling the depressions made by glacial waters. Many depressions are still filled by swamps and shallow lakes (pl. 1). The impure peat is a gray to black powdery material composed by organic debris mixed with silt and clay. At many places it is only a few feet thick, but at drill hole 47 it is 15 feet thick.

The Recent deposits are landslide debris, talus, and alluvium. The landslides occurred at three places along the base of the cliff that forms the northern boundary of the upper basalt. The talus of basalt is derived from the cliff, and it is associated with the landslide material. Alluvium occurs on the flood plain of the Spokane River at the northwest corner and along the eastern portion of the mapped area.

Clay Deposits

General Features

The U. S. Bureau of Mines drilled 162 holes for a total of approximately 1,590 feet. Drilling was done by hand, using 3-inch post hole augers of the Iwan type. Logs of some of the drill holes are in the appendix. Samples were taken at 5-foot intervals or where the material showed a marked change. The samples were prepared in a drying room at Huetter, Idaho, and were sent to the Bureau of Mines, Northwest Experiment Station, Seattle, Wash., to be assayed. One hundred and ten samples were assayed for ignition loss, available alumina, and available ferric oxide (table 3 and appendix).

Table 3. Drill hole data, Stockton clay deposits.

The samples were calcined for one hour at 700° C., and the loss in weight, due to the escape of moisture, organic matter, and a small amount of CO_2, is reported as ignition loss. The loss on ignition depends primarily upon the quantity of clay.

Available alumina (Al_2O_3), as defined by Skinner and Kelly (1949, p. 6), is the amount of alumina extracted from clay that has been dried at 130° C. overnight, weighed, calcined at 700° C. for one hour, and boiled in a 20 percent solution of sulfuric acid for one hour. The quantity of available alumina has been shown to depend upon the degree of weathering, and thus on the kind and amount of clay minerals. In general, the more complete the weathering, the higher the available alumina content.

The available ferric oxide (Fe_2O_3) is defined as the percentage by weight of ferric oxide in the calcined clay that is soluble in 20 percent solution of sulfuric acid under the same conditions as above. Because ilmenite is not appreciably soluble in sulfuric acid, its iron content, for the most part, is not available; therefore, the quantity of available ferric oxide is mainly dependent on the quantity of limonite and to a minor degree on the quantity of nontronite.

Table 1 gives the percentage of other constituents, including avail-

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Table 1. Analyses of Stockton clays.

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able alumina and available ferric oxide, for two transported clay samples and one granitic residual clay sample.

Table 1.--Analyses of some Stockton clays

	Sample C [a]	Sample F [a]	Sample I [a]
SiO_2	51.2	58.4	68.5
Al_2O_3	19.6	29.6	22.0
Fe_2O_3	3.4	1.9	1.0
CaO	2.0	1.55	0.0
MgO	0.04	0.04	0.07
K_2O	--	--	0.72 [b]
Ign. loss	10.6	9.1	7.8
Total	--	100.59	100.09

Sample C: Gray, fine-grained, transported clay from dump of well (pl. 1; coordinates 13,875Y; 5,090X). Skeels (1920, p. 32-33), Sample No. 14.

Sample F: White, massive, fine-grained, transported clay from 4-foot face of hole (pl. 1; coordinates 13,570Y; 3,360X), Skeels (1920, p. 35-36). Sample No. 19.

Sample I: Pink, tan, and white, granitic residual clay, containing some muscovite and abundant large grains of quartz, from road cut (pl. 1; coordinates 9,980Y; 2,500X). Scheid's Sample No. 50 in 1938; analyzed by R. V. Lindquist.

a/ Sample corresponds to those of table 2.

b/ Contains sodium. Sodium and potassium were precipitated as chloride and the result was converted to K_2O, as most of the alkali was thought to be potassium.

Three types of clay were found during the investigation of the Stockton deposits. The granitic residual clay is the product of the weathering of granite gneiss in place, and the basaltic residual clay is the product of the weathering of basalt in place. The transported clays are derived primarily from the weathered debris of the granitic rocks that has been transported and deposited in water. Basaltic residual clay is limited in quantity in the Stockton area and has no economic value.

Granitic Residual Clay

The granitic residual clay occurs at the surface as a discontinuous narrow strip along the contact of the granite gneiss and the Latah formation. Elsewhere, it underlies most of the Latah formation. The thickness of the granitic residual clay is not known, but 48.5 feet was penetrated in drill hole 1.

The granitic residual clays preserve the texture of the original granite gneiss, and they grade downward into hard, unweathered rock. The best grades of these clays are white, gray, or pink in color, but are locally stained yellow or brown by iron oxides. Kaolinite, the principal clay mineral, is formed from feldspar and to a minor extent from muscovite and biotite. Quartz remains unaltered and occurs abundantly throughout the granitic residual clay.

Fifty-two samples of granitic residual clay were assayed by the U. S. Bureau of Mines. The average assay values are as follows: available alumina, 12.1 percent, and available ferric oxide, 2.0 percent.

Basaltic Residual Clay

The basaltic residual clay is very limited and of no economic value. This type of clay retains the original basaltic texture to some degree. The fine- and even-grained texture is sharply defined by the abundant, small, uniformly disseminated flakes of blue-black ilmenite. The texture in the residual clay is more sharply defined than in the fresh basalt, in which the texture is often indistinct when examined with a hand lens. No assays were made on the basaltic residual clay.

Transported Clay

The transported clay occurs throughout much of the area, but very seldom crops out. The Latah formation is composed of the weathered debris of the Belt rocks, the granite gneiss, and to a very minor extent the Columbia River basalt. It was deposited upon the granitic and basaltic residual clays in lakes that were formed by streams dammed by post-Excelsior interval flows of basalt.

The transported clays are fairly plastic, gray, yellow and occasionally pink or red. Kaolinite is the principal clay mineral in the transported clay and its formation was completed before being transported and deposited. The clays contain a certain amount of fine-grained quartz and muscovite flakes and a small amount of organic material. Lenses of sand and limonite occur locally in the clay.

Fifty-eight samples of transported clay were assayed by the U. S. Bureau of Mines. The average content of available alumina was 15.4 percent and of available ferric oxide was 2.6 percent.

Ceramic Data

The Stockton deposits were investigated as a possible source of high-alumina clay; however, the clay is too low-grade and the deposits too small for that purpose. Nevertheless, the deposits do contain bodies of transported and granitic residual clays that should be potentially useful in the ceramic industry.

Information published by Skeels (1920, p. 31) shows that there are several deposits of clay throughout Kootenai County usable for most ordinary ceramic uses. Table 2 shows the ceramic data published by Skeels and the

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Table 2. Ceramic tests of clays from Stockton and Stanley Hill clay deposits.

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results of the ceramic tests made on samples collected by the author.

Skinner and Kelly (1949, p. 37) made many ceramic tests on a large number of samples of high-alumina transported clays of two similar deposits, the Olson and Excelsior deposits. They demonstrated that a high degree of correlation existed between the refractoriness and the percentage of available ferric oxide and available alumina (Skinner and Kelly, 1949, p. 8). Many of the clays at Olson and Excelsior were shown to be suitable for intermediate heat duty (pyrometric cone equivalent of 26 to 31) and high heat duty (P. C. E. 31-33), while some were suitable for super heat duty (P. C. E. 33). The transported clays of the Stockton deposit are very similar to those of the Olson and Excelsior, and they would probably yield similar ceramic results. Judging from the work of Skinner and Kelly, nearly all clays containing more than 15 percent available alumina and not more than 5 percent available ferric oxide will be usable for ceramic products.

Stockton Deposits

For purposes of discussion the Stockton deposit has been divided into the West, Southwest, Central, East, and North bodies. Four of the five bodies occur in the valley along the contact between the Columbia River basalt and the granite gneiss. The fifth body is at the north edge of the basalt ridge. The overburden at each of the five bodies is only a few feet thick and is composed of soil, unconsolidated older glacial debris, or loose boulders.

The West body (pl. 1) is an area approximately 1,200 feet long and 150 to 300 feet wide, and about 10 to 20 feet thick. The overburden consists of 1 to 2 feet of soil.

The Southwest body (pl. 1) is an area approximately 600 feet long and 300 feet wide and about 10 to 15 feet thick. The soil overburden is thin. No chemical assays of ceramic tests were made, and it is probable that the body contains a poorer grade clay than the other bodies.

The Central body (pl. 1) is an area approximately 2,200 feet long and 450 feet wide, and the average thickness is about 18 feet. The overburden consists of 1 to 5 feet of soil and some loose boulders.

The East body (pl. 1) is approximately 1,500 feet long and 400 feet wide, and averages about 12 feet thick. The overburden consists of soil and older glacial deposits that are from 1 to 10 feet thick.

The North body is an area about 375 feet north-south and 200 feet east-west, and the average thickness is about 17 feet. The overburden ranges from a few inches to 8 feet of unconsolidated glacial till and loose basalt talus.

To be considered as a source of aluminum, the clay must average less than 10 percent available ferric oxide and more than 20 percent available alumina. The deposit should also be of sufficient size and favorably located to permit easy and economical mining. Table 3 gives the more important drill hole assay data of the Stockton clays. Of the 110-odd samples assayed, only 17 were sufficiently high to be considered high-alumina clay.

Stanley Hill Clay Deposit

Several occurrences of transported clay in the general vicinity of the Stockton deposits were examined by the author. All of them are clays of the Latah formation, and most of them occur east of the Stockton deposits and north of Coeur d'Alene Lake. Of the occurrences, Stanley Hill is the only deposit that has a potential economic value.

The Stanley Hill deposit occupies a large part of the $N\frac{1}{2}SE\frac{1}{4}$ sec. 7, T. 50 N., R. 3 W., Boise meridian. It is about 2 miles northeast of the city of Coeur d'Alene. A paved highway passes within a few hundred yards of the deposit. Stanley Hill is an eastward trending ridge with an altitude of about 2,900 feet, and it forms the western edge of the Coeur d'Alene mountains. A line of three small elliptical hills diverge from the south slope of Stanley Hill at an elevation of 2,500 feet. Stanley Hill is underlain by pre-Cambrian Belt quartzites, and the smaller elliptical hills are underlain by Columbia River basalt, and at least one sedimentary clay bed is present under two of the small hills. The saddle between the eastern and middle hill is underlain by transported clay, but in the area between the middle and western hills the transported clay has been eroded away. The basalt above the transported clay of the middle hill forms a small conical capping that thickens from a few inches to about 30 feet.

A prospect on the west side of the middle hill was dug 23 feet and then drilled for another 38 feet, and the entire 61 feet was in clay. Several other holes were dug in the area, and all of them had clay at the bottom.

Skeels (1920, p. 33-35) reported on three samples obtained from the Stanley Hill area, and the results of Skeel's test are given in table 2. Tests of samples indicate that the transported clay is useable for many structural ceramic purposes.

The extent and thickness of the transported clay is unknown, but the deposit is limited by the configuration of the upper basalt surface. The deposit probably underlies an area that measures 500 feet north-south and 1,000 feet east-west. The thickness of the deposit is not known; however, a figure of 30 feet was assumed.

Conclusion

Under emergency conditions, the Stockton and Stanley Hill deposits, although small, could serve as a source of aluminum. The deposits contain large reserves of clay for ceramic wares such as: brick, terra cotta, and drain tile. It is also within easy reach of Spokane, Wash.

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APPENDIX

Formation	Interval (feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-1: Coord. 3,400X, 13,500Y		
Tl	0.0- 3.0	Soil		
	3.0- 7.0	Clay, transported, brown, plastic.	2.4	20.4
	7.0-11.5	Clay, transported, gray, plastic.)	2.9	20.8
	11.5-16.5	Clay, transported, gray, micaceous, plastic)		
	16.5-18.5	Clay, transported, red, plastic. Water zone.	1.6	22.8
	18.5-22.5	Clay, transported, light brown, sandy.	1.1	16.3
	22.5-25.5	Clay, transported, chocolate brown, plastic.	1.1	13.8
	25.5-28.5	Clay, transported, light tan, micaceous, plastic.	1.1	7.9
Kgn	28.5-32.0	Clay, residual, gneissic, brown.	1.7	6.1
	32.0-38.5	Clay, residual, gneissic, sandy and micaceous.	1.0	3.7
	38.5-39.5	Clay, residual, gneissic, reddish brown.	5.3	3.9
	39.5-41.0	Clay, residual, gneissic, tan, sandy.	1.4	4.6
	41.0-42.0	Clay, residual, gneissic, sandy, limonitic.	5.0	9.3
	42.0-45.0	Clay, residual, gneissic, coarse sandy, limonitic.	1.6	11.8
	45.0-49.0	Clay, residual, gneissic, tan, silty.	0.7	11.1
	49.0-57.5	Clay, residual, gneissic, tan, sandy.	0.9	10.1
	57.5-58.5	Sand, residual, gneissic, grayish orange-pink.	3.3	9.3
	58.5-62.0	Clay, residual, gneissic, brown.	1.4	14.2
	62.0-63.5	Clay, residual, gneissic, pink, sandy.	1.6	12.6
	63.5-64.5	Clay, residual, gneissic, grayish orange-pink.	2.6	14.8
	64.5-67.0	Clay, residual, gneissic, white, sandy.	1.6	15.8
	67.0-77.0	Clay, residual, gneissic, grayish orange-pink	1.9	12.3

Formation	Interval (feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-2: Coord: 3,200X, 13,500Y		
Tl	0.0- 3.5	Soil		
	3.5- 6.0	Clay, transported, light tan, plastic.	1.4	23.0
	6.0-10.0	Clay, transported, light yellow, plastic.	0.6	19.6
	10.0-20.5	Clay, transported, plastic, limonitic.	1.3	17.8
	20.5-22.5	Clay, transported, limonitic.	6.3	15.5
	22.5-23.0	Limonite		
		Drill Hole St.-3: Coord: 3,000X, 13,500Y		
Xgn	0.0- 4.0	Soil		
	4.0- 7.0	Clay, residual, gneissic, light tan, sandy, slightly plastic.	1.8	17.6
	7.0-10.0	Clay, residual, gneissic, red, sandy and micaceous.	3.0	15.7
	10.0-22.0	Clay, residual, gneissic, brown, sandy, partially weathered feldspar.	1.8	13.0
	22.0-25.0	Clay, residual, gneissic, coarse-grained sand.	2.4	11.6
	25.0-29.5	Clay, residual, gneissic.	2.4	13.8
	29.5-31.5	Clay, residual, gneissic, quartz pebbles.	0.3	13.7
	31.5-35.0	Clay, residual, gneissic, sandy.	0.4	16.6

Formation	Interval (feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-4: Coord. 2,700X, 13,500Y		
Qgo	0.0- 1.0	Soil and glacial material.		
Tl	1.0- 5.0	Clay, transported, limonitic.	0.6	18.4
Kgn	5.0- 6.5	Clay, residual, gneissic, brown.	1.1	15.5
	6.5-10.0	Clay, residual, gneissic, white and brown.	0.9	15.1
	10.0-11.5	Clay, residual, gneissic, light yellow.	0.3	15.9
	11.5-17.0	Clay, residual, gneissic, reddish brown, sandy.	1.1	17.1
	17.0-19.0	Clay, residual, gneissic, white and brown.	1.1	16.7
	19.0-23.0	Clay, residual, gneissic, yellowish white.	1.6	17.0
	23.0-25.5	Clay, residual, gneissic, limonitic.	3.1	12.3
	25.5-30.0	Clay, residual, gneissic, brown, sandy.	2.0	11.6
	30.0	Semidecomposed gneiss.		
		Drill Hole St.-5: Coord. 3,000X, 13,000Y		
Kgn	0.0- 3.0	Soil		
	3.0- 6.5	Clay, residual, genissic.	3.4	13.6
	6.5- 9.5	Clay, residual, genissic, red, sandy, semi-decomposed feldspar.	4.2	12.8
	9.5-12.0	Clay, residual, genissic, red, brown streaks.	4.0	10.7
	12.0-15.5	Clay, residual, gneissic, brown, sandy, semi-decomposed feldspar.	4.3	12.9
	15.5-18.5	Sand, residual, gneissic, quartz and semi-decomposed feldspar.	4.0	11.2
	18.5-21.5	Clay, residual, gneissic, brown.	2.1	15.5
	21.5-25.0	Clay, residual, gneissic, brown, quartz and semi-decomposed feldspar.	3.9	15.4
	25.0-26.0	Clay, residual, gneissic, quartz and semi-decomposed feldspar.	4.8	14.6
	26.0	Semi-decomposed gneiss.		

Forma- tion	(Feet)	Description	Fe_2O_3	Al_2O_3
		Drill Hole St.-6: Coord. 3,500X, 13,000Y		
Tl	0.0-4.0	Soil		
	4.0-8.0	Clay, transported, light brown, very hard	2.4	24.5
	8.0-22.0	Clay, transported, light tan, plastic	2.1	18.4
Kgn	22.0-24.0	Clay, residual, gneissic, sandy, limonitic	4.4	9.0
	24.0-25.0	Clay, residual, gneissic, yellowish brown	7.6	6.3
	25.0-35.0	Clay, residual, gneissic, light gray, sandy	1.8	10.7
	35.0-38.0	Clay, residual, gneissic, limonitic, micaceous	2.1	9.8
		Drill Hole St.-7: Coord. 2,600X, 13,000Y		
Qgb	0.0- 3.0	Bog Deposit		
Tl	3.0- 5.0	Clay, transported, gray	2.2	13.6
	5.0- 6.0	Clay, transported, plastic	2.1	20.1
Kgn		Gneiss		
		Drill Hole St.-8: Coord. 3,400X, 12,500Y		
Tl	0.0- 0.5	Soil		
	0.5- 5.0	Clay, transported, light tan	1.9	23.3
	5.0- 7.5	Clay, transported, light purple, very plastic	1.4	25.9
	7.5-11.5	Clay, transported, gray plastic	1.6	23.6
	11.5-15.0 15.0-18.0	Clay, transported, limonitic) Clay, transported, limonitic, coarse-grained quartz)	2.2	19.7
		Drill Hole St.-9: Coord. 3,000X, 12,500Y		
Kgn	0.0- 5.5	Soil		
	5.5- 6.5	Gneiss		

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-10: Coord: 3,000X, 12,000Y		
Kgn	0.0- 4.0	Soil		
	4.0- 5.0	Clay, residual, gneissic		
		Drill Hole St.-11: Coord: 2,300X, 12,000Y		
Tl	0.0- 1.0	Soil		
	1.0- 5.0	Clay, transported, limonitic, sandy		
	5.0- 6.0	Clay, transported, gray		
Kgn	6.0-10.0	Clay, residual, gneissic, sandy	3.3	16.3
	10.0-29.0	Clay, residual, gneissic, sandy and micaceous	2.3	15.0
		Drill Hole St.-12: Coord. 3,000X, 11,500Y		
Kgn	0.0- 4.5	Soil		
	4.5- 6.0	Clay, residual, gneissic, red, coarse-grained quartz		
	6.0- 9.0	Clay, residual, gneissic, white, sandy, semi-decomposed feldspar		
	9.0-12.5	Clay, residual, gneissic, brown, sandy, semi-decomposed feldspar contain iron oxide		
		Drill Hole St.-13: Coord. 3,400X, 11,500Y		
Tl	0.0- 1.0	Soil		
	1.0- 8.0	Clay, residual, gneissic		
		Drill Hole St.-14: Coord. 2,600X, 11,500Y		
Kgn	0.0- 3.0	Soil		
	3.0- 5.0	Clay, residual, gneissic, semi-decomposed feldspar		
Tl	0.0- 1.0	Soil		
Kgn	1.0- 3.0	Gneiss		

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-16: Coord. 3,400X, 11,000Y		
Kgn	0.0- 4.0	Soil		
	4.0-	Gneiss		
		Drill Hole St.-17: Coord. 2,900X, 11,000Y		
Tl	0.0- 2.0	Soil		
	2.0- 4.0	Clay, transported		
		Drill Hole St.-18: Coord. 2,500X, 11,000Y		
Tl	0.0- 3.5	Soil		
	3.5- 8.0	Clay, transported, purple, hard		
		Drill Hole St.-19: Coord. 3,000X, 18,000X		
Qgb	0.0-10.5	Bog deposit		
Tl	10.5-16.0	Clay transported, dark gray, plastic	1.4	9.3
Kgn	16.0-25.0	Sand, residual, gneissic, coarse-grained		
		Drill Hole St.-20: Coord. 3,300X 17,500Y		
Qgb	0.0- 5.5	Bog deposit		
Tl	5.5-12.5	Clay, transported, light gray, plastic	1.3	10.4
	12.5-14.0	Clay, transported, light gray, sandy	0.9	16.4
Kgn	14.0-25.0	Sand, residual, gneissic		

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tion	(Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-21: Coord. 3,000X, 18,300Y		
Qgb	0.0- 5.5	Bog deposit		
Tl	5.5-10.0	Clay, transported, light gray, plastic	0.6	1.3
	10.0-13.25	Clay, transported, light gray, very hard	2.0	18.4
		Drill Hole St.-22: Coord. 2,800X, 17,00Y		
Qgb	0.0- 7.0	Bog deposit		
Tl	7.0- 8.0	Clay, transported, light gray, sandy		
Kgn	8.0-15.0	Clay, residual, gneissic	2.4	9.2
		Drill Hole St.-23: Coord. 3,100X, 16,000Y		
Qgb	0.0- 3.0	Bog deposit		
Tl	3.0- 4.0	Clay, transported, gray, sandy		
Kgn	4.0-18.5	Clay, residual, gneissic, quartz and feldspar		
		Drill Hole St.-24: Coord. 2,800X, 16,300Y		
Qgb	0.0- 4.0	Bog deposit		
	4.0- 9.0	Clay, transported, green, plastic	6,2	14.0
	9.0-11.0	Clay, transported, coarse-grained, quartz and semi-decomposed feldspar	5.2	18.5
		Drill Hole St.-25: Coord. 3,000X, 15,500Y		
Qgb	0.0- 5.5	Bog deposit		
Kgn	5.5- 8.0	Clay, residual, gneissic, reddish brown		
	8.0-11.5	Clay, residual, gneissic, grayish orange-pink, micaceous		
	11.5-12.5	Clay, residual, gneissic, brown, limonitic, sandy		

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-26: Coord. 3,100X, 15,500Y		
Kgn	0.0- 1.5	Soil		
	1.5- 8.0	Clay, residual, gneissic, red, micaceous, sandy	0.6	2.7
	8.0-11.0	Clay, residual, gneissic, grayish orange-pink	1.6	15.4
	11.0-19.0	Clay, residual, gneissic, red	2.1	18.1
	19.0-20.0	Clay, residual, gneissic, brown	2.1	15.5
	20.0-25.0	Clay, residual, gneissic, pink and white	1.0	14.0
	25.0-36.0	Clay, residual, gneissic, white, sandy and micaceous	0.6	13.2
	36.0-41.0	Clay, residual, gneissic, white, sandy, micaceous	1.3	7.1
		Drill Hole St.-27: Coord. 3,000X, 15,100Y		
Kgn	0.0- 2.0	Soil		
	2.0- 5.0	Clay, residual, gneissic, sandy, limonitic		
	5.0- 8.0	Clay, residual, gneissic, gray, sandy		
	8.0-23.0	Clay, residual, gneissic, gray, sandy, brown-streaked		
	23.0-25.0	Clay, residual, gneissic, coarse-grained sandy, semi-decomposed feldspars		
		Drill Hole St.-28: Coord. 2,800X, 15,000Y		
Qgo	0.0- 4.0	Soil and glacial material		
Kgn	4.0- 9.0	Clay, residual, gneissic, micaceous, coarse-grained sand		
	9.0-10.0	Clay, residual, gneissic, sandy, semi-decomposed feldspar		
		Drill Hole St.-29: Coord. 3,600X, 17,300Y		
Qgo	0.0- 0.5	Soil and glacial material		
Tl	0.5- 5.0	Clay, transported, light tan,hard	1.0	3.4
	5.0-10.0	Clay, transported, light gray, hard	0.4	9.2
	10.0-14.0	Clay, transported, gray-brown, plastic, soft)	1.1	3.7
	14.0-14.5	Clay, transported, limonitic)		

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-30: Coord. 3,500X, 17,000Y		
Qgo	0.0- 5.0	Soil		
	5.0-10.0	Glacial sand and pebbles		
Kgn	10.0-15.0	Sand, residual, gneissic, micaceous	1.5	9.6
		Drill Hole St.-31: Coord. 3,560X, 17,500Y		
Tl	0.0- 1.0	Soil		
	1.0- 5.0	Clay, transported, white, plastic	2.0	10.1
	5.0-10.0	Clay, transported, light tan, plastic	2.0	10.8
	10.0-15.0	Clay, transported, tan, plastic	1.7	8.9
	15.0-20.0	Clay, transported, light brown, plastic	1.7	10.5
	20.0-25.0	Clay, transported, reddish brown, plastic	2.0	16.9
	25.0-30.0	Clay, transported, limonitic, plastic	2.0	8.6
		Drill Hole St.-32: Coord. 3,600X, 17,700Y		
Tl	0.0- 0.5	Soil		
	0.5-20.5	Clay, transported, gray, plastic	1.3	17.0
	20.5-23.5	Clay, transported, light gray, plastic	1.5	16.8
	23.5-25.0	Clay, transported, dark gray, plastic	1.7	18.4
	25.0-31.5	Clay, transported, light brown, limonitic	3.6	10.5
		Drill Hole St.-33: Coord. 2,700X, 18,000Y		
Qgo	0.0- 5.0	Glacial Material		
Tl	5.0- 6.0	Clay and gravel, transported		
Kgn	6.0- 8.0	Semi-decomposed gneiss		

Forma- tion	(Feet)	Description	Fe_2O_3	Al_2O_3
		Drill Hole St.-34: Coord. 3,000X, 17,500Y		
Qgb	0.0-5.0	Bog deposit		
Tl	5.0-6.0	Clay, transported, gray, coarse-grained sand		
Kgn	6.0-8.0	Sand, residual, gneissic, coarse-grained		
		Drill Hole St.-35: Coord. 3,100X, 17,500Y		
Qgb	0.0-5.0	Bog deposit		
Tl	5.0-6.0	Clay, transported, gray, coarse-grained sand		
Kgn	6.0-8.0	Sand, residual, gneissic, coarse-grained		
		Drill Hole St.-36: Coord. 3,000X, 17,000Y		
Qgb	0.0-5.0	Bog deposit		
Kgn	5.0-6.0	Gravel, residual, gneissic, coarse-grained		
		Drill Hole St.-37: Coord. 3,400X, 17,000Y		
Qgb	0.0-4.0	Soil and basalt float		
		Drill Hole St.-38: Coord. 3,000X, 16,500Y		
Qgb	0.0-5.1	Soil and basalt float		
		Drill Hole St.-39: Coord. 3,100X, 16,500Y		
Qgb	0.0-3.0	Bog deposit		
		Drill Hole St.-40: Coord. 3,200X, 16,500Y		
Qgb	0.0-3.0	Bog deposit		

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-41: Coord. 3,300X, 16,500Y		
Qgb	0.0- 3.0	Bog deposit		
		Drill Hole St.-42: Coord. 3,000X, 16,300Y		
Qgb	0.0- 3.0	Bog deposit		
		Drill Hole St.-43: Coord. 3,655X, 17,500Y		
Tl	0.0- 4.0	Soil		
	4.0- 8.0	Clay, transported, tan		
	8.0-16.0	Clay, transported, hard		
		Drill Hole St.-44: Coord. 3,635X, 17,600Y		
Tl	0.0- 6.0	Soil		
	6.0-11.0	Clay, transported, gray, slightly plastic	4.8	8.1
	11.0-15.0	Clay, transported, limonitic, slightly plastic	5.7	5.3
	15.0-20.0	Clay, transported, gray, brown-streaked, plastic	2.1	10.9
	20.0-25.0	Clay, transported, bluish gray, plastic	1.7	12.6
	25.0-29.5	Clay, transported, bluish gray and brown, plastic	4.7	12.5
		Drill Hole St.-45: Coord. 5,100X, 13,900Y		
Tl	0.0- 4.0	Soil		
	4.0- 9.0	Clay, transported, gray, plastic	2.5	26.1
	9.0-14.0	Clay, transported, reddish brown, plastic	5.1	21.3
	14.0-18.0	Clay, transported, gray and brown, micaceous plastic	3.8	22.6
	18.0-23.0	Clay, transported, light gray, plastic	2.9	24.6
	23.0-28.0	Clay, transported, light gray, micaceous, plastic	2.4	22.4
	28.0-31.0	Clay, transported, reddish brown, sandy	10.9	14.8

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-46: Coord. 5,100X, 14,000Y		
Qgo	0.0- 5.5	Glacial material		
Tl	5.5- 8.0	Clay, transported, grayish black	3.4	5.5
	8.0-18.0	Clay, transported , grayish brown, plastic	3.0	21.6
	18.0-28.0	Clay, transported, reddish brown, plastic	5.3	20.4
	28.0-40.0	Clay, transported, light gray, plastic	5.9	22.7
	40.0-41.0	Limonite		
		Drill Hole St.-47: Coord. 3,200X, 18,000Y		
Qgb	0.0-15.0	Bog deposit		
		Drill Hole St.-48: Coord. 5,300X, 13,500Y		
Qgo	0.0- 7.0	Soil and glacial material		
Tl	7.0-15.0	Clay, transported, gray and brown, sandy	5.3	15.4
	15.0-20.0	Clay, transported, gray and brown, micaceous and sandy	3.2	15.1
	20,0-25.0	Clay, transported, dark brown, micaceous and sandy	5.1	10.2
	25.0-40.0	Clay, transported, light brown, micaceous and sandy	2.0	6.1
		Drill Hole St.-49: Coord. 4,800X, 14,300Y		
Qgo	0.0- 3.0	Soil		
	3.0- 6.0	Glacial till		
Tl	6.0- 7.0	Sand, transported, cemented by limonite		
Tcr	7.0-11.0	Clay, residual, basaltic, blue-black, tan bidellite		
	11.0-15.0	Clay, residual basaltic, yellow bands of limonite		
	15.0-20.0	Clay, residual, basaltic, blue, limonite	12.9	25.2

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-50: Coord. 3,500X, 13,500Y		
Tl	0.0- 5.0	Soil		
	5.0-10.0	Clay, transported, light tan		
	10.0-15.0	Clay, transported, iron-stained		
	15.0-30.0	Clay, transported, plastic		
		Drill Hole St.-51: Coord. 3,465X, 13,600Y		
Tl	0.0- 3.5	Soil		
	3.5- 7.0	Clay, transported, light gray, plastic		
	7.0- 8.0	Sand, transported		
	8.0-20.5	Clay, transported, plastic		
		Drill Hole St.-52: Coord. 3,300X, 13,500Y		
Tl	0.0- 2.0	Soil		
	2.0- 7.0	Clay, transported, plastic		
	7.0-19.0	Clay, transported, purple, plastic		
		Drill Hole St.-53: Coord. 3,700X, 14,000Y		
Qgb	0.0- 2.0	Bog deposit		
		Drill Hole St.-54: Coord. 3,700X, 14,000Y		
Qgb	0.0- 2.0	Bog deposit		
		Drill Hole St.-55: Coord. 3,800X, 14,100Y		
Qgb	0.0- 2.0	Bog deposit		
		Drill Hole St.-56: Coord. 3,700X, 13,900Y		
Qgb	0.0- 2.0	Bog deposit		

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-57: Coord. 3,800X, 13,900Y		
Qgb	0.0-4.0	Bog deposit		
		Drill Hole St.-58: Coord. 3,600X, 13,900Y		
Qgb	0.0-3.0	Bog deposit		
		Drill Hole St.-59: Coord. 3,500X, 13,900Y		
Qgb	0.0-1.0	Bog deposit		
		Drill Hole St.-60: Coord. 3,400X, 13,900Y		
Tcru	0.0-2.0	Soil and basalt		
		Drill Hole St.-61: Coord. 3,500X, 13,800Y		
Qgb	0.0-4.0	Bog deposit		
		Drill Hole St.-62: Coord. 3,300X, 13,800Y		
Tcru	0.0-3.0	Soil and basalt		
		Drill Hole St.-64: Coord. 3,700X, 13,800Y		
Qgb	0.0-5.0	Bog deposit		
		Drill Hole St.-65: Coord. 3,700X, 13,700Y		
Qgb	0.0-5.0	Bog deposit		
		Drill Hole St.-66: Coord. 3,800X, 13,700Y		
Tcru	0.0-3.0	Soil and basalt		

tion	(Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-67: Coord. 3,600X, 13,700Y		
Qgb	0.0- 2.0	Bog deposit		
		Drill Hole St.-68: Coord. 3,500X, 13,700Y		
Tcru	0.0- 0.5	Soil and basalt		
		Drill Hole St.-69: Coord. 3,400X, 13,700Y		
Tl	0.0- 2.0			
		Drill Hole St.-70: Coord. 4,900X, 14,000Y		
Qgo	0.0- 9.0	Glacial material and basalt float		
		Drill Hole St.-71: Coord. 3,200X, 14,000Y		
Tl	0.0- 2.0	Soil		
	2.0- 7.0	Clay, transported, gray, sandy, plastic		
	7.0-12.0	Clay, transported, light gray, plastic		
	12.0-13.0	Clay, transported, gray-purple, plastic		
	13.0-18.0	Clay, transported, gray and brown streaked, plastic		
	18.0-33.0	Clay, transported, bluish gray, plastic		
	33.0-36.0	Clay, transported, gray		
		Drill Hole St.-72: Coord. 3,300X, 14,000Y		
Tcru	0.0-2.0	Soil and basalt		
		Drill Hole St.-73: Coord. 3,000X, 14,000Y		
Tcru	0.0-3.0	Soil and basalt		

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-74: Coord. 2,800X, 14,000Y		
Qgo	0.0-1.0	Glacial material		
		Drill Hole St.-75: Coord. 2,700X, 14,000Y		
Qgo	0.0-3.0	Glacial material		
		Drill Hole St.-76: Coord. 2,600X, 14,000Y		
Qgo	0.0-6.0	Glacial material		
		Drill Hole St.-77: Coord. 4,900X, 14,100Y		
Qgo	0.0-2.0	Glacial material		
		Drill Hole St.-78: Coord. 4,900X, 14,200Y		
Qgo	0.0-2.0	Glacial material		
		Drill Hole St.-79: Coord. 4,900X, 14,300Y		
Qgo	0.0-1.0	Glacial material		
		Drill Hole St.-80: Coord. 4,900X, 14,400Y		
Tcru	0.0-2.0	Soil and basalt		
		Drill Hole St.-81: Coord. 5,000X, 14,100Y		
Qgo	0.0-1.0	Glacial material		
		Drill Hole St.-82: Coord. 5,000X, 14,200Y		
Qgo	0.0-2.0	Glacial material		

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-83: Coord. 5,000X, 14,300Y		
Tcru	0.0-2.0	Soil and basalt		
		Drill Hole St.-84: Coord. 5,000X, 14,400Y		
Tcru	0.0-3.0	Soil and basalt		
		Drill Hole St.-85: Coord. 5,000X, 14,500Y		
Tcru	0.0-2.0	Soil and basalt		
		Drill Hole St.-86: Coord. 5,100X, 14,100Y		
Tcru	0.0-2.0	Soil and basalt		
		Drill Hole St.-87: Coord. 5,100X, 14,200Y		
Tcru	0.0-3.0	Soil and basalt		
		Drill Hole St.-88: Coord. 5,100X, 14,300Y		
Tcru	0.0-2.0	Soil and basalt		
		Drill Hole St.-89: Coord. 5,100X, 14,400Y		
Tcru	0.0-1.0	Soil and basalt		
		Drill Hole St.-90: Coord. 5,100X, 14,500Y		
Tcru	0.0-2.0	Soil and basalt		
		Drill Hole St.-91: Coord. 5,100X, 14,600Y		
Tcru	0.0-3.0	Soil and basalt		
		Drill Hole St.-92: Coord. 5,000X, 13,900Y		
Tcru	0.0-2.0	Soil and basalt		

		Drill Hole St.-93: Coord. 5,000X, 13,800Y
Tcru	0.0- 3.0	Soil and basalt
		Drill Hole St.-94: Coord. 5,000X, 13,700Y
Tcru	0.0- 2.0	Soil and basalt
		Drill Hole St.-95: Coord. 5,000X, 13,600Y
Tcru	0.0- 1.0	Soil and basalt
		Drill Hole St.-96: Coord. 5,000X, 13,500Y
Tcru	0.0- 3.0	Soil and basalt
		Drill Hole St.-97: Coord. 2,900X, 14,000Y
Qgo	0.0- 2.5	Glacial material
Kgn	2.5- 7.0	Clay, residual, gneissic, pink, micaceous
	7.0-17.0	Clay, residual, gneissic, brown
		Drill Hole St.-98: Coord. 5,800X, 14,600Y
Qt	0.0- 3.0	Talus
Tl	3.0-10.0	Clay, transported, gray, limonite-streaked
	10.0-11.0	Limonite
	11.0-14.0	Clay, transported, limonitic
	14.0-15.0	Clay, transported, dark brown, limonitic
	15.0-19.0	Clay, transported, gray, limonite-stained
	19.0-19.25	Limonite
	19.25-24.0	Clay, transported, gray, micaceous
	24.0-30.5	Clay, transported, gray, limonite-streaked
	30.5-39.0	Clay, transported, gray
	39.0-40.0	Clay, transported, gray, micaceous, limonite-streaked

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-99: Coord. 3,100X, 15,400Y		
Tl	0.0- 1.0	Soil		
	1.0- 5.0	Clay, transported		
	5.0-10.0	Clay, transported, light gray		
Kgn	10.0-14.0	Clay, residual, gneissic, dark gray		
	14.0-20.0	Clay, residual, gneissic, dark brown		
	20.0-44.25	Clay, residual, gneissic, pink		
		Drill Hole St.-100: Coord. 3,200X, 15,400Y		
Tl	0.0- 6.0	Soil		
	6.0-11.0	Clay, transported, sandy		
	11.0-16.0	Clay, transported, gray		
Kgn	16.0-21.0	Clay, residual, gneissic, brown sandy		
		Drill Hole St.-101: Coord. 3,200X, 15,700Y		
Kgn	0.0- 6.0	Soil, sandy		
	6.0-11.0	Clay, residual, gneissic, pink and brown		
	11.0-30.0	Clay, residual, gneissic, brown, sandy and micaceous		
		Drill Hole St.-102: Coord. 3,000X, 15,700Y		
Qgb	0.0- 4.0	Bog deposit		
Kgn	4.0-10.0	Clay, residual, gneissic, sandy, limonitic		
	10.0-15.0	Clay, residual, gneissic, sandy		
		Drill Hole St.-103: Coord. 3,000X, 14,500Y		
Kgn	0.0- 2.0	Soil		
	2.0- 7.0	Clay, residual, gneissic, gray, micaceous		

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-104: Coord. 2,900X, 14,500Y		
Qgb	0.0- 1.0	Bog deposit		
Kgn	1.0- 4.25	Clay, residual, gneissic, gray, sandy		
	4.25-13.0	Clay, residual, gneissic, tan, micaceous, sandy, semi-decomposed feldspar.		
		Drill Hole St.-105: Coord. 3,200X, 16,000Y		
Qgb	0.0- 4.0	Bog deposit		
Tl	4.0- 9.0	Clay, transported		
Kgn	9.0-10.0	Clay, residual, gneissic		
		Drill Hole St.-106: Coord. 3,800X, 13,000Y		
Tcru	0.0- 1.0	Soil		
	1.0- 4.0	Semi-decomposed basalt		
	4.0- 5.0	Clay, residual, basaltic		
		Drill Hole St.-107: Coord. 3,800X, 13,100Y		
Tcru	0.0- 4.0	Soil and basalt		
		Drill Hole St.-108: Coord. 5,100X, 13,700Y		
Qgo	0.0- 2.5	Glacial material		
Tl	2.5- 4.0	Clay, transported, grayish, purple		
		Drill Hole St.-109: Coord. 3,600X, 13,200Y		
Tl	0.0- 3.0	Soil and clay, transported		
		Drill Hole St.-110: Coord. 3,600X, 13,100Y		
Tl	0.0- 2.0	Soil and clay, transported		

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-111: Coord. 3,700X, 12,900Y		
Tl	0.0- 3.5	Soil and clay, transported		
		Drill Hole St.-112: Coord. 3,800X, 12,900Y		
Tcru	0.0- 3.5	Soil and basalt		
		Drill Hole St.-113: Coord. 5,800X, 14,300Y		
Qt	0.0- 9.0	Talus		
		Drill Hole St.-114: Coord. 5,840X, 14,800Y		
Qt	0.0- 8.0	Talus		
		Drill Hole St.-115: Coord. 5,260X, 13,480Y		
Qt-Tl	0.0-15.0	Clay, transported, gray		
Kgn	15.0-18.0	Clay, residual, gneissic, coarse-grained sand		
		Drill Hole St.-116: Coord. 5,320X, 13,650Y		
Qt	0.0- 2.0	Soil and talus		
Kgn	2.0- 7.0	Clay, residual, gneissic, coarse-grained sand		
	7.0-11.0	Sand, residual, gneissic, coarse-grained semi-decomposed gneiss		
		Drill Hole St.-117: Coord. 5,350X, 13,650Y		
Qt	0.0- 5.0	Soil and talus		
	5.0-10.0	Clay, transported, gray, sandy		
	10.0-14.0	Sand, transported, brown		

Formation	Interval (Feet)	Description	Avail. Fe_2O_3	Avail. Al_2O_3
		Drill Hole St.-118: Coord. 5,560X, 13,370Y		
Qt	0.0- 6.0	Soil and talus		
Tl	6.0-11.0	Clay, transported, brown, sandy		
		Drill Hole St.-119: Coord. 5,800X, 14,420Y		
Qt	0.0- 5.0	Soil and talus		
	5.0- 8.5	Clay, transported, gray, very hard		
	8.5-10.0	Clay, transported, brown, limonite-streaked, plastic		
	10.0-15.0	Clay, transported, brown, sandy		
	15.0-20.0	Clay, transported, light brown, sandy		
	20.0-25.0	Clay, transported, light brown, micaceous, sandy		
		Drill Hole St.-120: Coord. 4,500X, 16,000Y		
Qgb	0.0- 7.0	Bog deposit		
Tl	7.0-15.0	Clay, transported, plastic		
		Drill Hole St.-121: Coord. 3,800X, 15,100Y		
Qgb	0.0- 2.0	Bog deposit		
		Drill Hole St.-122: Coord. 3,800X, 15,000Y		
Qgb	0.0- 3.0	Bog deposit		
		Drill Hole St.-123: Coord. 3,800X, 14,900Y		
Qgb	0.0- 2.0	Bog deposit		
		Drill Hole St.-124: Coord. 3,800X, 14,800Y		
Qgb	0.0- 3.0	Bog deposit		
		Drill Hole St.-125: Coord. 3,900X, 14,900Y		
Qgb	0.0- 1.0	Bog deposit		

Forma- tion	Interval (Feet)	Description	Fe_2O_3	Al_2O_3
		Drill Hole St.-126: Coord. 4,000X, 14,900Y		
Qgo	0.0-2.0	Glacial material		
		Drill Hole St.-127: Coord. 4,100X, 14,900Y		
Qgo	0.0-3.0	Glacial material		
		Drill Hole St. -128: Coord. 3,900 X, 14,800Y		
Qgo	0.0-1.0	Glacial material		
		Drill Hole St.-129: Coord. 3,700X, 14,900Y		
Qgb	0.0-8.0	Bog deposit		
		Drill Hole St.-130: Coord. 4,600X, 15,500Y		
Qgo	0.0-4.0	Glacial material		
		Drill Hole St.-131: Coord. 4,600X, 15,400Y		
Tcru	0.0-3.0	Soil and basalt		
		Drill Hole St.-132: Coord. 4,600X, 15,600Y		
Qgo	0.0-2.0	Glacial material		
		Drill Hole St.-133: Coord. 4,600X, 15,700Y		
Qgo	0.0-5.0	Glacial material		
		Drill Hole St.-134: Coord. 4,700X, 15,600Y		
Qgb	0.0-3.0	Bog deposit		
		Drill Hole St.-135: Coord. 4,800X, 15,500Y		
Qgb	0.0-1.0	Bog deposit		

tion		Description	Fe_2O_3	Al_2O_3
		Drill Hole St.-136: Coord. 4,900X, 15,600Y		
Qgb	0.0-3.0	Bog deposit		
		Drill Hole St.-137: Coord. 5,000X, 15,600Y		
Tcru	0.0-3.0	Soil and basalt		
		Drill Hole St.-138: Coord. 5,100X, 15,600Y		
Tcru	0.0-4.0	Soil and basalt		
		Drill Hole St.-139: Coord. 5,100X, 15,500Y		
Qgb	0.0-2.0	Bog deposit		
		Drill Hole St.-140: Coord. 5,100X, 15,400Y		
Qgb	0.0-3.0	Bog deposit		
		Drill Hole St.-141: Coord. 5,000X, 15,400Y		
Qgb	0.0-6.0	Bog deposit		
		Drill Hole St.-142: Coord. 4,900X, 15,400Y		
Qgb	0.0-2.0	Bog deposit		
		Drill Hole St.-143: Coord. 4,800X, 15,400Y		
Tcru	0.0-2.5	Soil and basalt		
		Drill Hole St.-144: Coord. 4,700X, 15,400Y		
Qgb	0.0-1.5	Bog deposit		
		Drill Hole St.-145: Coord. 3,700X, 17,100Y		
Qgo	0.0-6.0	Glacial material		

Forma- tion	(Feet)	Description	Fe_2O_3	Al_2O_3
		Drill Hole St.-146: Coord. 3,800X, 17,100Y		
Qgo	0.0 - 5.25	Glacial material		
Tl	5.25-15.25	Clay, transported, dark and light gray		
	15.25-20.0	Clay, transported, brown and gray		
Kgn	20.0-21.5	Sand, residual, gneissic		
		Drill Hole St.147: Coord. 3,900X, 17,180Y		
Qgo	0.0-5.5	Glacial material		
		Drill Hole St.-148: Coord. 4,000X, 17,265Y		
Qgo	0.0-4.5	Glacial material		
		Drill Hole St.-149: Coord. 4,100X, 17,300Y		
Qgo	0.0-5.0	Glacial material		
		Drill Hole St.-150: Coord. 4,225X, 17,375Y		
Qgo	0.0-5.0	Glacial material		
		Drill Hole St.-151: Coord. 4,290X, 17,250Y		
Qgo	0.0-6.0	Glacial material		
		Drill Hole St.-152: Coord. 5,000X, 16,450Y		
Qgb	0.0-4.5	Bog deposit		
		Drill Hole St.-153: Coord. 3,100X, 17,000Y		
Qgb	0.0-3.5	Bog deposit		
		Drill Hole St.-154: Coord. 3,200X, 17,000Y		
Qgb	0.0-3.0	Bog deposit		

Forma- tion	(Feet)	Decision	Fe_2O_3	Al_2O_3
		Drill Hole St.-155: Coord. 3,300X, 17,000Y		
Qgb	0.0-4.0	Bog deposit		
		Drill Hole St.-156: Coord. 5,000X, 14,900Y		
Qgo	0.0-5.5	Glacial material		
		Drill Hole St.-157: Coord. 4,900X, 14,900Y		
Qgb	0.0-3.0	Bog deposit		
		Drill Hole St.-158: Coord. 4,800X, 14,900Y		
Qgb	0.0-4.0	Bog deposit		
		Drill Hole St.-159: Coord. 4,800X, 15,000Y		
Tcru	0.0-2.5	Soil and basalt		
		Drill Hole St.-160: Coord. 4,800X, 14,800Y		
Tcru	0.0-2.0	Soil and basalt		
		Drill Hole St.-161: Coord. 4,700X, 14,900Y		
Qgb	0.0-3.25	Bog deposit		
		Drill Hole St.-162: Coord. 4,600X, 14,900Y		
Qgb	0.0-5.0	Bog deposit		
		Drill Hole St.-163: Coord. 4,500X, 14,900Y		
Qgo	0.0-4.75	Glacial material		

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