V. Douglas
Book no. 2

Clays.

G. West Douglas.

1942.

The average weight of a pot or pig is 1 lb. and this sells for say 50 cents.

I make a trade amounting to $100 000.00 per annum.

This figure means 200 000 lbs of clay made up into articles.

The ratio of made up clay to raw of quarry clay is approx. 1 to 1.5

∴ 200 000 × 1.5 = 300 000 lbs

The industry should be planned for 25 years so that 25 × 300 000 or 7,500,000 lbs of clay should be in the deposit

$\frac{7,500\,000}{2000}$ = 3,750 tons.

In round figures they should have a deposit of 5000 to 10,000 tons.

Angus Kell has sand & loam.
Antigonish.
Neil Cram.

Preliminary Report on Antigonish Clays.

The Antigonish Board of Trade made a request for geological advice regarding the clays in the vicinity of the town. A visit to Antigonish to ascertain the ~~[illegible]~~ problem and make a preliminary examination of the sources of the clay, was made during the last part of July 1942.

The whole project at Antigonish is in its early exploratory stage. Nothing has been done except to set up a sub-committee of the Board of Trade which has had a few meetings to consider the possibility of starting a pottery industry. Mrs Hagen of Malone Bay has been conducting classes in pottery at Mount St Bernard, a convent in Antigonish and she has trained a number of the nuns in the art. One of these nuns, known as Sister St Philip has become very proficient in the handling of

Clay including the firing.
In this Nunnery there are some very interesting exhibits of the articles produced in this school. Most of the articles have been made from the clays from Lantz given to this institution by Mrs L. S. Shaw. There are a few pots and jugs made of the local clays. It has been the policy of Mrs Stagen to encourage her pupils to find and bring in their own clays with the result that a number of occurrences of clay ~~are~~ is known but none of these can even claim the name of a pit. The samples which have been brought in ~~have~~ ~~represent~~ have weighed only a few pounds and often represent the efforts of a young girl with a trowel collecting a bucket of clay to take to the convent classes. Obviously many of these samples cannot be thought of as representing commercial sources of clay.

The first thing to be determined in an examination of this description was the quantity of material which would be required to ~~get~~ supply an industry over a period of years. I met Mr B.A. Mossay, the manager of the Canadian Bank of Commerce in Antigonish and Mr A.R. McDonald ~~a member~~ both members of the Board of Trade. Some of these fundamental questions were discussed. Fortunately Mrs Hayes was teaching at the Summer School and with her help the basis of the problem became clearer. The whole problem has a number of facets which will be listed as follows:-

a. Size of deposit required
b. Quality of deposit.
c. The question of ~~Capital~~ Markets.
d. The question of Capital.
e. The geological problems involved.
f. The actual establishment and operation of the plant.

Typist please note

I shall now deal with these headings in the order given.

292 185) 292 (1.4
185
1070
1168

185) 298 (1.62
185

1.62
50 cents
100 000

$\frac{1.62}{50} \times 100{,}000$

a. Size of the deposit required.

A number of articles made by Mr Hagen which included teapots, jugs, jars &c were weighed. They varied from 1/4 lbs to 2 3/4 lbs and a fair average would be 1.61 pounds. A teapot or jug of this weight would probably cost 50 cents. The Board of Trade have as a goal a trade amounting to about $100 000.00 per annum. This sum of money would represent about 322 000 pounds of finished Clay products. Mr Hagens experience is that the ratio of raw quarry Clay to weight of clay made up into the finished articles is 1.5 to 1 and it may be even higher depending on the quality of the clay & the amount of coarse material which has to be screened out. Accepting the 1.5 to 1 ratio the figure for quantity would be

322,000
25
16 100 000
644 000
83 000 000
10 000 000
2 000

100 00 000

16 100 000

100 x 100 = 100,00

40 000
5
20 0,000

62.4
2
124.8

say 128
12 000
250 00,000
2 000

bbl 000
25
3220000
128
16100000
2 000

x y 5 125
2000 = 10000

80
400 2000
2000 x 10000

xy =

62.4

x x 4 x 128 = 16,100
2000

16100 x 2000
x x 128

32 000

x = 160

4000
16,100 x 2000
x x 128

2000
40
80,000

Say 80 x 400
or 160 x 200
or 320 x 100

630,000
210
3000
63,000

320
100
63 000 sq ft

484,000
~~300 000~~ pounds, taking a ratio of 2 to 1, 644,000 pounds per annum would be required.

It was the opinion of the two Board of Trade members that the industry should be planned for 25 years, we then have - between 12,100,000 to 16,100,000 pounds as the weight of clay required for a twenty-five year period. Reducing this larger figure to short tons ~~xxx~~ and doubling it to meet emergencies we get a figure of 16,100 short tons. In other words ~~to~~ a deposit of clay is required which contains 16,100 tons. ~~Putting this figure in terms of an hypothetical field with a depth of clay of 5 feet uniform over the area. The field should measure 80 by 400 feet or 160 by 200 feet or 320 by 100 feet~~

See over page

Typist please continue here →

Putting this figure in terms of a field with an uniform depth of four feet of clay the area required for this pit ~~is as follows~~ would be 63,000 square feet or say a field 300 feet long by 210 feet wide.

It can thus be seen that the size of the source of material is not very large. During ~~[illegible]~~ this preliminary investigation no ~~[illegible]~~ exact measurements were made but deposits which did not roughly measure up to the requirements were not seriously considered. Samples were taken at a number of places and when these have been tested for quality the exact dimensions of area and depth will have to be made. This work will require a certain amount of pitting but will not involve much of an outlay.

36
8½
18
288
306
8
2448
2472

8

36
8
288
18
306
8
2448

b. Quality of the Deposit.

Although it may be safely stated that the more that is known of the physical and chemical characteristics of any material the better it is for all those concerned; nevertheless in the pottery industry the practical tests of ~~[illegible]~~ working, firing and using the articles has been found to be adequate in many cases. This statement is specially true in connexion with what may be described as rough pottery - brown teapots, jugs and such articles. Even the highest class articles will break if dropped and a life of ten years for a teapot is considered good. For these reasons it is possible that the testing of the material can be done in Nova Scotia and in this particular case I should

recommend that the preliminary testing be done by Sister St Philip of the Mount St. Bernard Convent. After she has reported favourably on any clay a representative sample of the run of pit clay should be sent to Mrs Hagen at Ulakone Bay. Mrs Hagen is equipped to report on the quality of the clay and the temperature required for firing.

It should be most strongly emphasized that the success of the enterprise depends not only on the excellence of the quality but also on the outward attractiveness of the articles. Stereotyped designs, attempts to ape the pottery of other centres should be vigorously avoided.

Cheap Japanese attempts to ape the ~~pottery~~ pottery of various European

products can be seen in almost any five and Ten Cent Store.]
Antigonish must produce something new, ~~and~~ useful, attractive and reasonably durable.

C. Question of Markets—
The Board of Trade of Antigonish should commence at once an investigation into the possible markets for pottery. The figure of $100 000.00 was taken as the base for the calculation of possible tonnages. That figure is based on hope and desirability, two very fickle goddesses. The market possibilities will have to be very thoroughly explored and the onus of responsibility for this exploration must rest with the Board of Trade of Antigonish.

d. The question of Capital –

This question involves two questions – first – the amount of Capital and secondly the source of the Capital. The first of these is again a problem which will have to be investigated by the Board of Trade either by obtaining the services of a Ceramic expert or obtaining Capital costs from some operating plant willing to give the information.

The second part of the question involves a more tricky decision. If outside Capital is sought it is highly probable that before that Capital decides to invest in Antigonish many other localities will be investigated elsewhere in Nova Scotia and in the other parts of the Dominion of Canada. From what I

have seen of the clays in California and in other parts of this continent I should not describe the local clays as outstanding in either quality or quantity. It is therefore evident that if the people of California want a pottery industry they must look to themselves for the driving force in capital, initiative and creativeness.

e. The establishment and operation of the plant.

If the project is decided upon, that is if the quality of the material is sufficiently good to warrant action; if the capital is found to launch the project it is most imperative that a man be found who will be capable of taking charge of the operations. The ideal

The question of fuel for firing the pottery would have to be carefully studied. It is possible that the Dept. of Engineering at St Francis Xavier might be able to help in the design of a suitable furnace and run some tests on various grades of coal or saw-dust.

person would be a young man from Antigonish County, a graduate of St Francis Xavier who had been sent to study in some pottery centre and who after a year or two of practical work would return to his native town and make this industry go. Again, if the decision to go ahead is made no time should be lost in selecting such a man and providing him with funds to carry out his study, such funds to be included in the initial capitalization.

The Board of Trade should make contracts with all the wholesale dealers in the Maritimes to arrange for the vending of their wares.

f. The Geological Problems -

Clays are fine grained Clastic sedimentary products. The size of the average particle has been variously given from $\frac{1}{256}$ of a millimetre to $\frac{1}{500}$ of a millimetre. Many of the particles are colloidal in dimensions (0.1 μ to 0.1 μμ)
Ashley (1) defines a clay as a mixture of "Minerals of which the representative members are silicates of aluminium, iron, the alkalies, and the alkaline earths."
Twenhofel (2) states that the most satisfactory classification of clays is based on origin. He distinguishes seven classes:- residual, glacial, fluvial, lacustrine, marine, volcanic and aeolian.

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(1) U.S.G.S. Bull 388 - p.7. 1909
(2) Treatise on Sedimentation - Williams & Wilkins p.188.

The Antigonish Clays ~~xxxlly~~ strictly speaking are of glacial origin but the glacial material has been often washed from its position as it was left by the ice and concentrated in local depressions and stream beds so that it might also be classed as lacustrine and fluvial.
There are considerable areas of moraine in the vicinity of Antigonish. The morainic material is boulder clay or till.
Some of these moraines are extremely sandy and some of them contain more clay than others.
There are also fluvio-glacial deposits in the area such as eskers. In general it may be said that if an area containing eskers is encountered clay deposits should be sought south of that area. This was the principle used together with as much local information as could

obtained. The best deposits seem appeared to be in local depressions south of a moraine from which the clayey ~~[illegible]~~ particles had been washed.

Some of the ~~Physical~~ Properties of Clay.

The bulk density of dry clay varies for each locality ~~[illegible]~~ and should be determined on definite representative samples. An average for a dark clay would be 1.80
The same clay when wet would have a density of 2.05
The porosity of this dark clay is reported as 25.3 per cent. (3)
For calculating the tonnage in any deposit of wet clay the figure of 125 pounds per cubic foot may be taken.

(3) G.S.A. Handbook of Physical Constants p. 25.

Explanation of some terms used in connexion with pottery – Courtesy of Mrs Hagen.

Clays usually require a glaze or wash of material of various constituents. The glaze is the substance which imparts the shine to the outside of a pot. There are various glazes and the materials for the glazes would either have to be bought or procured locally. If procured locally it will be necessary to conduct some exploration for the source and some research for the adaptability of these materials. As an example of the materials required – the following are some glazes :–

#1 Feldspar	#2 Teapot Glaze
Whiting	Borax
Sand	Stone
Kaolin	White lead
	Flint

Please put in columns

#3 Majolica Glaze
White lead
Stone
flint

Another glaze uses Ball Clay. A number of these terms are peculiar to the industry -

Ball Clay is a blue clay - very plastic - cannot be used alone on account of excessive contraction.

Stone or Cornwall Stone is a disintegrated pegmatite in which the disintegration has not proceeded to the Kaolin stage.

Flint is a siliceous rock composed mainly of granular chalcedony with a small proportion of opaline silica. found in the Chalk. (Holmes)

It is claimed that mixing flint with Ball Clay and some other ingredients produces a white earthenware.

Whiting - is Carbonate of lime ($CaCO_3$)

Other materials are fluorspar, silica sand, Calcined bones, barytes, Sillimanite and Plaster of Paris.

~~Enough has been written to show that there are many things which have to be studied for a pottery Enterprise is started~~

It is possible that certain rocks and minerals found in Nova Scotia might be used in place of some of these that have been listed. As a suggestion I have drawn up the following list. The first column represents the specified article and the second column indicates whether it is found in Nova Scotia or a suggested substitute.

Required Article	Nova Scotia Product
Felspar	Governor's Lake Pegmatite could yield small amounts Possibly other sources.
Whiting	There are abundant outcrops of limestone in N.S.
Sand	There are beach sands and it is here suggested that some of the silica tailings from some Gold mills might be tested.
Kaolin	There is a little at New Campbellton C.B. Probably would have to be imported.
Borax	Would have to be imported.
Stone	Very probably could be found in N.S. Shelburne or Guysborough Counties.

White lead	would have to be imported.
Ball Clay	I imagine that a N.S. Clay could be found.
Flint	Possibly a nomfelo from the N.W. side of Lake Wallabrick might ~~act~~ act as a substitute.
Fluorspar -	found at Lake Ainslie and at St Lawrence Newfoundland.
Calcined Bones	Obtainable in N.S.
Sillimanite	Only small quantities in N.S. ~~the~~ Andalusite might be substituted
Plaster of Paris -	Gypsum can be obtained a few miles from Antigonish.
Barytes	Walton - Canadian Industrial Minerals.

Insert please

The question of a leadless glaze should have serious consideration on account of the danger of lead poisoning ~~for~~ to the workers.

Some thought would have to be given to pigments for colouring.

It can be seen that the question of raw materials requires careful study.

Please Start on a New Page

Location and report on local clays.

Sample No 1. from an eight foot bank of clayey till on Halbert Farm about one mile South of Antigonish.
Field is now under oats but area is extensive. May require considerable screening. Reddish colour when wet.
No 1a was taken from toe of bank where the rain had washed down some clay from the bank.

Samples No 2 and 2a. from the farm of Robert Chisholm at St Andrews. These were both reddish and greenish clays here. This area should be tested by pitting. Leo Chisholm, a son of ~~the~~ the owner should be encouraged financially to prove the area examined.

Sample No 3. Farm of D. J. Macgillivray, St Andrews. A very fine blue clay reported to be over four feet thick. This location appeared to contain the best clay examined. This area should also be tested by pitting.

Sample No 4. Farm of Jerome Chisholm, St Andrews. A clay of poor appearance.

Sample No. 5 - On side of road opposite Fraser farm South side Harbour road a poor reddish Clay.

Many other localities were Examined such as the Works' Head and the Exhibition Grounds but ~~th~~ there did not appear to be commercial deposits at these places.

The report of Sister St. Philip is appended.

Covering Letter.

Dr A.R. Cameron,
Dy Minister of Mines
Halifax.

Dear Sir,

Herewith you will have my preliminary report on the Clays of Antigonish. As you will see there has not been very much work done to date. The project is in its early exploratory stage.

I should like to record my appreciation of the help given to me by Mrs Hagen, the Sisters of St Bernard and St Martha and to Mr B.A. Mossey.

Would you kindly see that a copy of this report be sent to the Antigonish Board of Trade at the earliest possible date as they wish to come to

a decision regarding further investigations.

I remain, Sir,

Yours faithfully,

G. V. D.

26th July 1942