Documents on Testing of Artifacts
Oak Island, Nova Scotia
Compiled by Les MacPhie, May 8, 2005

Artifact	Document Description	Page
Brass foil from Becker Hole 21 recovered from 187 feet below original ground level (or higher) in May 1967	Letter by W. M. Williams, December 15, 1969 (no transmittal letter)	1
	Microphotograph (13 times magnification)	2
	Letter by W. M. Williams, February 20, 1970	3
Brass foil as above and metal pieces from Borehole 10 (Later called Hole 10X)	Transmittal letter to Stelco by Kerry Ellard, July 28th, 1970	4 and 5
	Stelco letter by A. B. Dove, August 18, 1970	6 and 7
Nails, spikes and metal tool from Smith's Cove excavation in September 1970	Transmittal letter to Stelco by Kerry Ellard, September 14th, 1970	8 and 9
	Stelco letter by A. B. Dove, September 25, 1970	10 to 12
Log structure, wood box and metal rule from Smith's Cove excavation in September 1970	Transmittal letter to Conservator at Fortress Louisbourg by Kerry Ellard, September 14th, 1970	13
	Transmittal letter to Conservator at Fortress Louisbourg by Kerry Ellard, October 14th, 1970	14 and 15
	Letter from Conservator at Fortress Louisbourg, Nov. 25, 1970	16 and 17
Metal rule as above	Transmittal letter to Stelco by Kerry Ellard, December 7th, 1970	18
	Stelco letter by A. B. Dove, December 14, 1970	19 and 20
Metal fragments from Golder Hole 201 located 100 feet north-northeast of Hole 10X, metal fragment from Golder Hole 202 located 3 feet west of Hole 10X and metal fragment from Hole 205 located 10 feet southwest of Hole 10X	Transmittal letter to Stelco by Golder Associates, November 6, 1970	21 and 22
	Transmittal letter to Stelco by Kerry Ellard, November 9, 1970	23
	Stelco letter by A. B. Dove, November 19, 1970	24 and 25
Chain, wire and piece of flat metal, from Hole 10X above 165 feet	Stelco letter by A. B. Dove, March 30, 1971 (no transmittal letter)	26 to 29
Spike and metal straps from northwest corner of Island and more chain and wire from 10X	Transmittal letter to Stelco by Kerry Ellard, April 19, 1971	30
	Kerry Ellard notes on telephone report by A. B. Dove, April 21st, 1971	31
	Stelco letter by A. B. Dove, April 22, 1971	32 and 33
Piece of wire from split spoon sample at 110 feet, hole located 660 feet north of Money Pit	Stelco letter by A. B. Dove, June 11, 1971 (no transmittal letter)	34
Cement from Hole 10X recovered from above 165 feet in 1971	Canada Cement Lafarge Ltd letter, March 14, 1977 (transmittal letter dated February 11 but no copy available)	35 to 37

T1a

T1b

364 Metcalfe Avenue,
Westmount, Quebec.
December 15th, 1969.

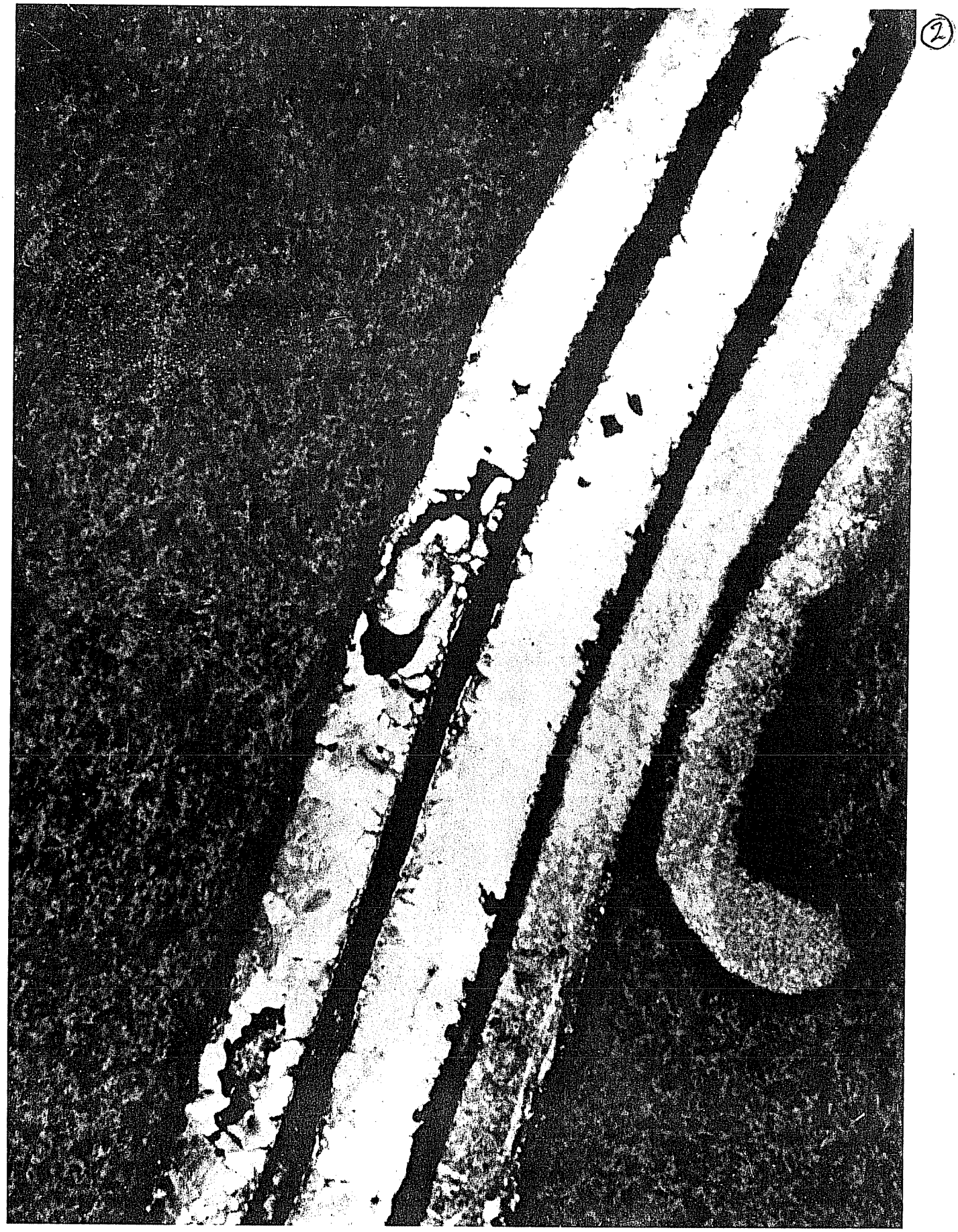
Mr. David C. Tobias,
30 Forden Avenue,
Westmount, Quebec.

Examination of Brass Sample

Macroscopic Examination A crumpled sample of brass foil, doubled over on itself several times, and distinctly corroded, was examined under the binocular microscope. The foil (or thin sheet) was about 0.02 in. thick and showed little of interest except for a tiny piece of woven material caught in one of the folds of the metal. This material was very similar to the light woven structure of a Panama straw hat. It crumbled very readily when the metal folds were prised open.

Microscopic Examination A sample of the metal was mounted in bakelite in such a way as to expose transverse sections of several thicknesses of foil. This sample was abraded, polished and finally etched in alcoholic ferric chloride to show up the metal microstructure. The structure was that of a typical brass (i.e. copper-zinc alloy) with very variable grain size. The surfaces of the brass had lost much of the zinc (i.e. it had "dezincified) as a result of its burial. Although dezincification commonly occurs in sea water, it can also occur in soil in as little as 10 or 20 years, so that dezincification is not necessarily a sign of old brass. More interesting was the presence of two small lumps of copper in one of the foils. These are shown in the accompanying photograph at a magnification of x13. These lumps may have got into the brass by accident during rolling and this circumstance may indicate primitive rolling practice. However there was nothing else in the microstructure to indicate the age of the sample. More definite information may be forthcoming when the results of a chemical analysis are known. This should be within about two weeks.

W. M. Williams, Ph.D., Eng.



(3)

364 Metcalfe Avenue,
Westmount,
Que.

February 20th, 1970

Mr. Kerry Allard
2105 Mountain Street
Montreal, P.Q.

Dear Mr. Allard:

I am writing to give you an interim report on the sample of crumpled brass foil which I have been examining on your behalf.

I have now had the material analyzed. Spectrographic analysis shows that the brass contains much higher levels of impurities than are normal in modern brass. In particular, high contents of silver (150 parts per million), lead (3000), antimony (150) and arsenic (90) strongly suggest a poorly advanced technology. In modern brass these impurities would be at much lower levels. It could well be that the brass was manufactured prior to the middle of the nineteenth century but I hope I shall be able to be more precise when I have heard from several experts in England, as well as in this country, to whom I have submitted the analysis.

Yours very truly

W. M. Williams

WMW:mb

(4)

July 28th, 1970.

Mr. Allan B. Dove,
Senior Development Metallurgist,
Steel Company of Canada Limited,
Wilcox Avenue,
Hamilton, Ontario.

Dear Mr. Dove:

Since you last heard from us, we have been engaged in a rather drawn-out drilling program on the island in order to gather engineering data prior to the construction of a shaft. At the same time, we rather hoped that this further drilling would produce some conclusive findings, which would indicate the most productive place to put the shaft. Unfortunately, this did not occur, and although we now have the drilling results correlated, we are still faced with the decision as to where best to sink the shaft. Because of this, we are sifting through the material brought up in previous drilling programs (1966 and 1967) in order to reevaluate it and ensure that we have overlooked no obvious possibilities.

With this in mind, I am taking the liberty of asking you to examine the enclosed material. The two containers with blue tops hold bits of metal brought up by a drill operating about 150 feet north of the area where searches have been carried out in the past. An accurate evaluation of the nature of this metal and its age could be a crucial factor in our decision as to where to locate a shaft. A number of responsible people associated with Oak Island over the years have always maintained that there was probably a tunnel running northward from the "Money Pit". This metal may be a vital clue as to the validity of their thinking and might lead us to an attempt at intercepting this tunnel. 10X

The other container, with the yellow top, contains a piece of brass which was brought up by a drill operating directly over one of the open shafts in the "Money Pit" area, but from a depth far greater than that reached by any previous searchers. This brass fragment has already been examined by specialists here in Montreal (I enclose a copy of their findings) but I would appreciate any opinion you might be able to offer as to its approximate age based upon your experience.

. . . 2

I realize that this is an imposition and can only justify myself by the complexity of our dilemma. Since the passage of time is putting us under an increasing pressure, I wonder if I could further ask you to telephone me with your findings at the earliest possible moment. A final decision on shaft location and exploration methods will have to be taken within the next two weeks and due to the immense cost involved, (close to $500,000) we cannot afford to make a mistake.

I hope you can sympathise with the urgency of our position and can see your way clear to help us.

Thank you for your generous cooperation in the past - we anxiously look forward to hearing from you at your earliest convenience.

Yours sincerely,

Kerry Ellard
Project Co-ordinator

ke.hr

(6)

The Steel Company of Canada, Limited

CANADA WORKS. Hamilton, Ontario.

August 18, 1970

The Oak Island Exploration
8200 Grande Allee
ST. HUBERT, P. Q.

Attention: Mr. K. Ellard
Project Co-Ordinator

Dear Mr. Ellard:

Further to our conversation, and my discussion with Mr. Tobias on August 14th, studies regarding the samples from the Oak Island Exploration indicate as shown below. The samples considered were:-

(a) Borehole 21 - Brass from 185 ft.
(b) Borehole 10 - Ferrous rolled material (D. C. Webster)
(c) Borehole 10 - Ferrous rolled material (D. Blankenship)

Physical and Chemical Properties

Sample	Thickness	Analysis		
(a)	.011 - .019 in.	Approx. 60-40 Brass ($\alpha + \beta$) plus Ag, Pb, Sb, As		
(b)	.016 - .025 in.	C - 0.238	P < 0.02	Mn - 0.45
(c)	.012 - .016 in.	C - 0.19	P < 0.02	Mn - 0.45

Observations on Analysis and Microsections

(a) The brass analysis reported by Mr. Williams (Feb. 20/70) is verified in microsections which do indicate lead and general contamination with relatively poor technology in preparation. Season cracking is evident, but more important, areas of unalloyed copper are seen, some of which are due to dezincification and/or poor production methods. The colour would confirm an α/β type brass of about 60:40 copper-zinc. I do not consider .03% lead excessive, but the presence of silver, antimony and arsenic would indicate the possible use of a "direct" production from calamine ore such as used before modern brass manufacture. In present times, brass is made from copper and zinc; in earlier times - even in the alchemist period, brass was made from copper to which charcoal and calamine were added. This latter method was still in use up to about 1850, and was well known before that time since it was simple and easily performed with a minimum of equipment. The variations in thickness can be the result of poor control technique and corrosion. Brass was used to sheath ships' bottoms in the 18th century, replacing copper.

(7)

(b) & (c)

Microscopically, these samples show a low temperature annealed ferritic structure to the edges, indicating possibly a final heat treatment. The structure is in keeping with the carbon analysis in regard to ferritic grain size. Early ferrous irons were "puddled" wrought irons, cementitic or crucible steels of analysis as follows:

	Carbon	Mn	P
Pig Iron Base	3.50 - 4.00	0.50 - 2.50	0.30 - 1.00
Cementitic Steel (1600 AD)	0.50 - 1.50		
Crucible Steel (1742 AD)	1.50 - 2.00		
Bessemer (Blow) (1856 AD)	0.03 - 0.10	Tr 0.06	0.08 - 0.10
Bessemer (Sheet)	0.01	0.30 - 0.50	0.100 max.
Thomas (1878)	Similar to Bessemer, but cleaner		
Carbon Steel	0.05 - 1.30	0.30 - 1.00	0.02 - 0.10
Wrought Iron (1856)	0.05 - 0.25	0.01 - 0.10	0.05 - 0.20
Puddled Iron (1613 - 1766)			0.17 - 0.20 (Swedish)
Swedish Iron	0.02	0.12	0.017

The presence of low phosphorous in a wrought iron indicates the possible use of low phosphorous Swedish irons, recarburized in process. Only in this way can I account for high slags shown in the microsection if the material were deposited prior to 1856, although low phosphorous puddled irons were known after 1613 although the process was not made economical until 1766. There is a period here in which the "puddled" iron was made in secret. The higher manganese value, however, is consistent with a steel of manufacture after 1856.

Commentary

1. The best guide to dating here would appear to be carbon-dating. Considering 1575 ± 85 years, we obtain AD 1490 to 1660 until the tree started to grow. Assuming 70 years to grow a 6 in. to 8 in. oak, the latest date becomes 1730. This places the time at 1655-1730, well within the "pirate period" of 1690-1691.

2. The brass could have been made by the early process using direct calamine additions with charcoal. This would explain the impurity content since zinc is frequently associated with silver, lead, antimony and arsenic.

3. The steel samples (a) and (b) contain slags, but the combination of 0.20 C and 0.45 Mn with low phosphorous, is very close to a C 1020 type steel, and while it may have been an early steel, it is unlikely to have been produced prior to 1856.

Yours very truly,
THE STEEL COMPANY OF CANADA, LIMITED

A. B. Dove
Senior Development Metallurgist
Wire and Fastener Divisions

(B)

September 14th, 1970.

Mr. A.B. Dove,
Senior Development Metallurgist,
Steel Company of Canada Limited,
Wilcox Avenue,
Hamilton, Ontario.

Dear Mr. Dove:

Here we go again! This time, I think we have a couple of things which may interest you. In any event, they are at least artifacts which may make your task a bit easier. Not knowing anything about nails or steel, it is impossible for me to tell which of these may be of the greatest significance. However, sample number 5 is of special interest, because it came from a wooden structure which we found buried beneath the beach. (Please see the enclosed sketch, where I have located the exact position where the nail was found.) All indications are that this structure is very old. The nail (or spike) was badly decomposed in the wood and it discoloured an area of about 3 inches in diameter around it. If you would like some further samples of this kind of nail, I may be able to have them sent directly from the site.

Most of the other samples came from an area within 100 feet of this structure, but because we were digging with a machine, it was sometimes difficult to determine the exact depth at which they were lying. Sample number 7 appears to be some kind of tool and while it looks familiar to many of us, nobody can remember where they have seen anything like it before.

You may be interested to know that we are having wood samples from the buried structure carbon dated, in the hope that we are finally on the track of something conclusive. Anything you can tell us about these samples will be important in reinforcing or casting doubt upon the other tests which are being carried out.

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Once again, let me thank you for your generous assistance. We are looking forward eagerly to hearing your evaluation.

Yours sincerely,

Kerry Ellard,
Project Co-ordinator

ke.hr

ENCLOSURE #4

(10)

The Steel Company of Canada, Limited

STELCO

CANADA WORKS, Hamilton, Ontario.

September 25, 1970

The Oak Island Exploration
6200 Grande Allee
St. HUBERT, P. Q.

Attention: Mr. K. Ellard
Project Co-ordinator

Dear Mr. Ellard:

Reference your letter of September 14th and the samples which arrived September 18th. The samples are listed as follows:

Sample #1: "Spike found on rocks about 15 ft. opposite the dock in the wall of coffer dam. Sept. 12/70".
This sample was end-sectioned and micro-examined longitudinally. The material is puddled wrought iron, hand-forged. The absence of heat limits dating.

Sample #2: "Found at West end of log in buried wooden structure - about 6' above log." Micro-examination of this round bar section shows hand-forged point on wrought iron material. No head available.

Sample #3: "Nail found close to sample #2." 2-3/4 in. hand-forged nail. Encrustation removed from nail head, and section roughly cleaned. The head is conical, hand made and stock is wrought iron.

Sample #4: "Nail from rocks near loose logs in coffer dam trench." Appears to be double-pointed nail used for log pinning, and of wrought iron. Corrosion is too extensive for proper identification.

Sample #5: "Nail from crosspiece in wooden construction taken from crosspiece between #V & #6". This is part of a machine-sheared nail made from wrought iron plate about 5/32" thick.

Sample #6: "Tool found below 'Searcher's' Dock in wall of coffer dam." This appears to be a hand-forged wrought iron caulking tool. This artifact has not been sampled in any way so as not to destroy any part of the exhibit.

(11)

Sample #7: "Nail from below 'Searcher's' Dock in wall of coffer dam." Head and part of the body of this approx. 5 in. nail have been cleaned to permit examination. The material is apparently wrought iron, hand-forged, simple counter-sunk head, flat top.

Sample #8: "Piece of spike, broken off a notched beam brought up while trenching coffer dam, section E, September 3, 70." This appears to be a part of a wrought-iron, hand-forged spike.

In the interest of preserving the samples, I have not destroyed samples for analysis; we have, however, sectioned small areas from Samples 1 and 2 for microsection. All samples appear to be wrought iron, hand-forged. The structures are as shown on photos marked "Sample #1" and "Sample #2" attached and illustrate low carbon stock with slag stringers resulting from the metal process employed. I would estimate the materials shown here to be produced prior to 1790 based on the metal, form used (hand-forged shapes). This conclusion applies to Samples 1, 2, 3, 5, 6, 7. Samples 4 and 8 are too greatly attacked to permit study without total destruction.

I am returning all the samples to you. Analysis could assist in solving some of the problems of source, but I would not undertake such distructive tests unless you expressly desire it.

If I can be of further assistance, please advise.

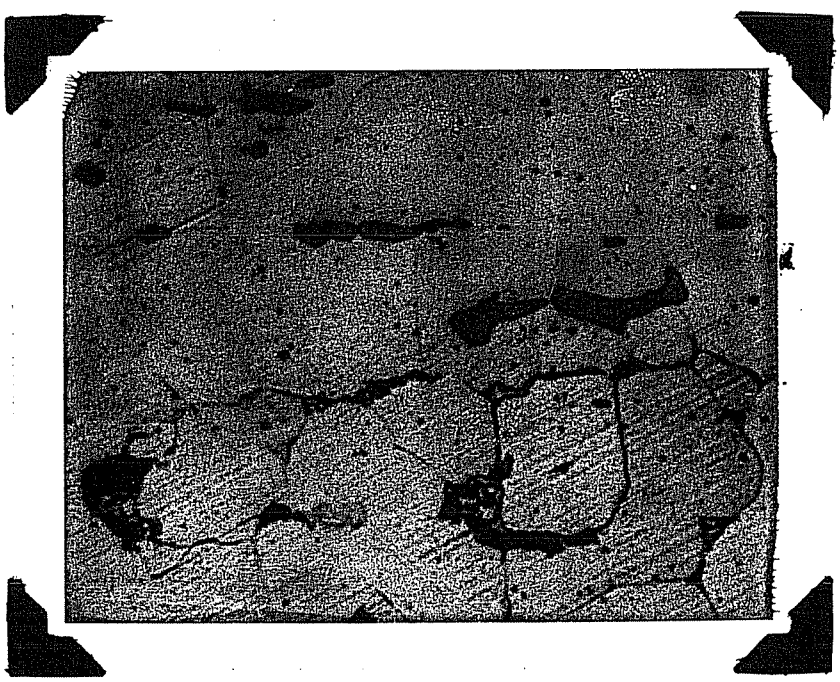
Yours very truly,
THE STEEL COMPANY OF CANADA, LIMITED

A. B. Dove
Senior Development Metallurgist
Wire and Fastener Divisions

ABD/ST

(12)

Sample #1 - showing slag stringers in low carbon ferretic network typical of puddled wrought iron. 330 X



Sample #2 - showing slag and phosphede stringers in low carbon ferritic network typical of puddled wrought iron. 330 X

(13)

September 14th, 1970.

Mr. John Dunton,
Conservator,
Fortress of Louisbourg,
Louisbourg, (Cape Breton Island),
Nova Scotia.

Dear John:

As I promised, I am sending you the pictures of the buried wooden structure we found at Smith's Cove, as well as our surveyor's plan showing its dimensions and the placing of the timbers. You may be interested to know that I was able to recover a similar piece of badly eroded spike from one of the crosspieces and that this has been sent to a metallurgist, who has made a study of the history of nails, for evaluation.

I am including a metal rule that we found at the same location and off to one side of the wooden structure. I think you will find it very interesting.

I hope that the other material I sent you (the pipe and the china) arrived safely and in good condition. I am sorry that they could not be sent closer than Sydney, but there does not seem to be any way of sending bulk packages directly to the Fortress. Once again, I would ask you to return all the samples and our photographs to me when you have completed your examination. Without wanting to impose too much, I would like to point out that time is of the essence, since our future plans hinge upon the establishment of the age and purpose of this structure.

Thank you again for your offer of assistance.

Yours sincerely,

Kerry Ellard,
Project Co-ordinator.

ke.hr

October 29th, 1970.

Mr. John Dunton,
Conservator,
Fortress of Louisbourg,
Louisbourg, Nova Scotia.

Dear John:

It has been some time since I last spoke to you and in the interim, considerable work has been done at the island. Perhaps the most interesting discoveries so far have been a log and a squared timber structure found below the sea bottom at Smith's Cove. I am enclosing photographs in the hope that someone at Louisbourg may be able to identify it. Dr. Howard Chappelle at the Smithsonian, a specialist in 18th century naval construction, states positively that it is not a dyke or a dock, and that it has nothing to do with ship construction. Beyond that, he confesses that he cannot even make a guess.

I am also enclosing a Polaroid picture of an unusual box found close to one end of the log structure. We think that it might have been some sort of forming box, but would appreciate any thoughts you may have on the matter.

I hope that you were able to do something with the fragment of framing square which I sent to you. When you have finished with it, I would very much appreciate receiving it back. I would also ask you to return these photographs, since they are the only prints I have.

Incidentally, you may be interested to learn that the pottery people at the Royal Ontario Museum suggested that we send any pottery we have to you. In their opinion "he is the best pottery man in the country...". I thought you would be gratified to learn that you are held in such high esteem.

Thanks again for your help. I look forward anxiously to hearing any thoughts you may have on the enclosed material.

Yours sincerely,

Kerry Ellard,
Project Co-ordinator.

.....2

P.S. The enclosed map and diagram are yours to keep. The map shows the general layout of the area behind the coffer dam and the location of the logs. The diagram was made when we uncovered the first notched log - co-ordinates D-E, 3-4x. However, the other logs confors to its description. The map may be useful later when we find further objects of interest. Incidentally, the wooden box was found at co-ordinates F-3. I have also included a diagram of it made by our operations director.

Department of
Indian Affairs and
Northern Development

CANADA

Ministère des
Affaires indiennes et
du Nord canadien

(16)

Mr. Kerry Ellard,
6200 Grande Allee,
St. Hubert, P.Q.

Louisbourg, N.S., Nov. 25, 1970.
our file/notre dossier
your file/votre dossier

Dear Kerry:

I am sorry for being so long in replying to your letter. We found the photos of considerable interest, but are as much in the dark as you. No one knows what the wooden structure is, or the "box". The metal rule or square is almost clean and should be in the mail about Monday, the 30th. I'll send the pipe (cast iron I believe) and pottery fragment too. Although the rule is hand-made, the numbers and lines being applied with punches, I suspect that it is 19th century, from the style of the numerals. It looks as though the set of punches was mixed, because of variations of design in the numbers. I shall stick my neck out and say the pipe and rule are contemporaneous with the pottery fragment - first half of the 19th century.

Yours sincerely,

John Dunton
Conservator
Fortress of Louisbourg
National Historic Park

Encl.

(17)

CONSERVATION OF IRON OR STEEL MEASURE
FROM OAK ISLAND EXPLORATION

On receipt, the measure was lightly covered with fine-grained rust, typical of flash rusting on newly exposed iron which has been in salt water. This gradually increased over a period of two weeks, and treatment became mandatory. The following steps were taken:

1. Photographed.
2. Preliminary light brushing and washing in tap water.
3. Cleaned in CRC Rust Remover for 4 hours.
4. Cleaned in electrolytic tank for 4 days, to remove salt.
5. Manual cleaning.
6. Rinsed in ultrasonic tank.
7. Washed in boiling distilled water for 2 days.
8. Manual brushing.
9. Acetone rinse followed by vacuum desiccator.
10. Coated with CRC 3.36 Rust Preventer,
11. Coated with acrylic spray.

With careful handling, the object should be free of further corrosion indefinitely. Should any failure occur, it would be appreciated if it were returned for examination and corrective treatment.

30 November 1970
Archaeological Laboratory
Fortress of Louisbourg
National Historic Park
Louisbourg, Nova Scotia

(1B)

December 7th, 1970.

Mr. A.B. Dove,
Senior Metallurgist,
Wire & Fastener Division,
The Steel Company of Canada Limited,
Hamilton, Ontario.

Dear Mr. Dove:

I am enclosing the rule which I have described to you on a couple of occasions and which we found near the log structure behind the coffer dam. I am also enclosing a description of the treatment it underwent while being examined at Louisbourg. We would be very interested in your comments on this rather unusual artifact.

I would also like to thank you again on behalf of everyone involved for your generous and extremely helpful assistance.

I am also enclosing a copy of a story which appeared in the Globe and Mail two weeks ago. In talking to the writer, I stressed the help that Stelco was giving us and will continue to do so in future unless I hear otherwise from you. Certainly, it is the least we can do to reciprocate.

Thank you again.

Yours sincerely,

Kerry Ellard
Project Co-ordinator

ke.hr
encls.

(19)

The Steel Company of Canada, Limited

STELCO

CANADA WORKS. Hamilton, Ontario.

December 14 1970

Mr. Kerry Ellard,
Triton Alliance Limited,
6200 Grande Allie,
St. Hubert, P.Q.

Dear Mr. Ellard,

Thank you very much for sending along the "rule" found behind the coffer dam on Oak Island. This is a most interesting sample and gives rise to many conjectures regarding its source.

It appears to be wrough iron - little doubt of it because of the way in which corrosion has occurred. In the absence of a metallurgical cross section I would suggest this most likely conclusion.

The figures are, of course, hand-engraved. The 2's indicate some freedom of expression on the part of the engraver. There are a few small errors as would be expected, in the half-inch measurements. More liberties were taken in the extensions to the unnumbered side of the blade, measurements here were less accurate. The 24th inch is complete to the center of the blade, not to the edge, due to rounding. The measurements are certainly English inches, not French "pouces" which measure 2.70 cms. instead of 2.54 inches.

I should suggest that this could have been a square rather than a ruler, used for laying off right angles and slopes. It is the proper width, length and thickness. This also explains the identical figures on opposite sides for marking above or below.

The age of the tool is, however, most important. Wrought iron strip was available for a very long time. Although wrought iron is first mentioned in literature about 1613, it had been produced in Belgium and Sweden long before. Certainly squares and measuring tools were well known in ancient times, but it is unlikely that rules of wrought iron were introduced until the late 1500's or early 1600's. Wrought iron was in use until 1925 when it provided about 3% of the low carbon iron output, but hand engraved measuring devices should be much earlier. The determination of date here then is a dilemma. It would probably be earlier than 1850 when cheap steel became available, it would be after 1783 if made by Cort's (or Onions') puddled iron process; how long before 1783, if produced by the Swedish, Belgium (Walloon) South Wales or Lancashire processes is a question. There were subtle differences in microstructure and analysis, but even these are not clear-cut in one piece of metal although they may be used in distinguishing one group from another.

cont/.....

(20)

On the basis of the fibrous corroded structure and the engraving, I would place the age of the artifact before 1783. I am purely guessing, of course, and would certainly not remove any of the material to attempt to support this. Perhaps Louisburg would comment on the engraving which is a most interesting feature.

With best Seasons wishes,

Yours very truly,
THE STEEL COMPANY OF CANADA, LIMITED.

A. B. Dove
Senior Development Metallurgist
Wire and Fastener Division

ABD/ad

Golder Associates

CONSULTING GEOTECHNICAL ENGINEERS

H. Q. GOLDER
V. MILLIGAN
J. L. SEYCHUK
C. O. BRAWNER
D. L. TOWNSEND
F. J. HEFFERNAN
B. E. W. DOWSE
J. B. DAVIS

(21)

November 6, 1970.

The Steel Company of Canada Ltd.,
334 Wellington Street North,
Hamilton 21, Ontario.

Attention: Mr. A. B. Dove, Senior Development Metallurgist

RE: THE OAK ISLAND EXPLORATION,
OAK ISLAND, NOVA SCOTIA.

Dear Sirs:

We have been requested by Mr. Ellard of Triton Alliance Limited to forward to you for examination and identification two (2) samples of metal obtained in borings put down at the above site. These samples, identified as Borehole 201, Sample 10 and Borehole 202, Sample 2, are inside the enclosed containers.

As discussed with you by telephone on November 5, 1970 these samples were obtained as follows:

Borehole 201, Sample 10 - The small metal fragments were embedded in a sample of dense sand obtained from a depth of 84.5 to 86.5 ft. below ground surface. Following sampling, the casing was advanced and during drilling between depths of 84 ft. and 85 ft. pine needles and wood chips were observed in the drillwater return. Small rusted metal fragments were also observed in Sample 12 (depth of 86.6 to 87.9 ft.) but these fragments were assumed to be from the drill rods or casing. The soil sample within which the pieces of metal were embedded was obtained using a 1-1/2 in. I.D. driven tube sampler. It should be noted that the metal fragments were embedded in rather than adhering to the sample. Consequently, it appears unlikely that the metal could have been introduced into the sample by the drilling operations.

Borehole 202, Sample 2 - Borehole 202 was put down using a direct circulation rotary drillrig. With this equipment no accurate sampling and description of subsurface conditions is possible. However, at a depth of about 125 ft. below ground surface the drilling resistance increased markedly and numerous wood chips were carried up in the wash. Carbon dating indicates that this wood is 18,000 years old but these results are questionable. Beneath the apparent timber the drilling resistance decreased for about 5 ft. and the drill water return was small (i.e., between depths of about 125 and 130 ft.). When the hole had been advanced to a depth of 150 ft. a blockage occurred in the drill rods and the rods were removed from the hole. A sample of the soil material in the rods was obtained and the piece of metal identified as Borehole 202 Sample 2 was found embedded in this soil. The depth from which the metal came can not be accurately established; only that it came from above a 150 ft. depth.

(22)

Mr. Ellard requests that you submit the results of your examination of these samples directly to Triton Alliance Limited with a copy to us.

If you have any questions regarding this letter, please call us.

Yours truly,

H. Q. GOLDER & ASSOCIATES LTD.

J. B. Davis, P. Eng.

JBD:jg
69126
Encl.
cc: Triton Alliance Limited

(23)

November 9, 1970

Mr. A. B. Dove
Steel Company of Canada
Chief Development Metallurgist
Wire & Fastener Div.
334 Wellington Street North
Hamilton 21, Ont.

Dear Sir:

Enclosed please find a small piece of iron taken from our bit at approx. 130' in bore hole #205 on Oak Island. This piece was approx. 13/4" X 1¼ X 5/8" thick and being irregular in shape. I broke off a very small corner. This metal plugged our rotary bit and deffinitely came from this hole. Other small pieces may have been forced out with the water and missed observation.

Both Kerry Ellard and David Tobias have asked that I send it to you and would very much appreciate a quick comparison to what could be a similar type of metal sent to you by Golder Industries of Toronto and actually came from a hole about 7' away.

Mr. Tobias has an important meeting set up for the end of this week and considers it quite important to know if this is man made or not.

Thanking you for any considerations in this matter.

Very truly yours

Daniel C. Blankenship
Project Manager

Copy to:
Kerry Ellard

Hole 205 - 10' overburden
@ 10'x
mar 20/05

(24)

The Steel Company of Canada, Limited

STELCO

CANADA WORKS, Hamilton, Ontario.

November 19, 1970

Triton Alliance Ltd.
6200 Grande Allee
ST. HUBERT, Quebec

Attention: Mr. K. Ellard
The Oak Island Exploration

Dear Mr. Ellard

I am sending this letter directly to you as requested in Mr. Davis' letter of November 6th. With Mr. Davis' letter were included two containers, numbered 13 and 20, having the appelations "Borehole 201, Sample 10" and "Borehole 202, Sample 2" respectively. The small metal fragments contained in Borehole 201, Sample 10 are too friable for any sort of consistent examination but their general structure indicates that they were produced from wrought iron which would date them prior to 1800. The foliation in the corroded samples is quite characteristic of that particular type of material.

The sample indicated as Borehole 202, Sample 2 appears to be a replacement material in which calciferous and siliceous material has replaced iron. Some of the iron is still contained in the calciferous material and, therefore, some portions are still magnetic. Other portions of this particular material are not magnetic at all and this suggests the replacement in sea water of the iron bicarbonates and of course the siliceous material which is visible. Even though two sides of this small sample appear to be at an angle of 90°, it would be quite difficult to state the origin or age of such a material. Such replacement processes are normally very slow so one could assume a considerable age.

A shipment was received from Mr. Blankenship which contained some pieces of wood thought to have nails embedded therein and a piece of iron bar with one end pointed in a chisel-type point. No nails were found in the wood; indeed, one protruding portion which was thought to be a nail, when opened was found to contain a wood nodule around which the wood had grown. These samples have been taped together again and are being returned to you. Even where iron salts had gathered on the outside of the wood, it will be seen that there is no nail inside, the nail having been chemically changed to soluble salts and transferred throughout the cellulosic material of the wood. The bar contained in this particular shipment, however, was very interesting. It is wrought iron of excellent consistency and very clean stock. It was probably produced in Europe and forged there. It is about the purest bit of iron that I have seen in a long time insofar as early materials is concerned. There would have been little purpose in producing a wrought iron after 1800 for such a tool as this.

(25)

The tool could have been used either as a pry bar or as a drift pin for major wooden construction. I was rather surprised that the corrosion had not been as great on this bar as on earlier materials but I would still believe that it was produced prior to 1800. The 300 magnification photographs of the cross-section are shown at photo number 1..

A second sample from Mr. Blankenship which was contained in a Kodak film box accompanied his letter of November 9th. In that letter he stated that the small piece of iron taken from the bit at approximately 130 ft. depth at Borehole 205 was included. This piece was said to be 1-3/4" x 1-3/4" x 5/8" thick and that he had broken off a very small corner. Mr. Blankenship suggested that the metal was similar to material taken from a hole about 7 ft. away. This is not the case. This is the most peculiar piece of metal yet studied as will be seen from photograph number 2. The main body of metal contains what would normally be accepted as a fairly normal iron for the early periods prior to 1760 - dirty, full of holes, and indeed not too abnormal for a piece of melted iron overflow from a furnace. Strangely enough, however, within this matrix there are small spheroids of very good steel - high carbon material - which apparently has resulted from deoxidation and purification of the outer shell. These particles are very small as will be seen from the curvature at 300 magnifications of the light portion of photograph number 2. These small particles of bright metal can be observed throughout the darker matrix. The darker material is overlaid with a fairly heavy scale which is not completely magnetic. This leads to the belief that this metal formed and hardened in an atmosphere low in oxygen, thereby accounting for the lower magnetic value of the outer body and the presence of the unoxidized particles on the outside of the sample. These particles, being almost a martensitic steel, are highly magnetic. I cannot acoount in any way for the formation of this material except that it was formed at very high temperature and in the absence of oxygen.

Again, in sending this letter, I do not know if I have helped you or hindered you. We can say quite surely that Mr. Blankenship's sample is not at all similar to the samples sent in by Mr. Davis. We can say that the bar is very pure wrought iron and was probably produced in Northern Europe. Had we found some nails in the wood, it might have been of considerable help, but the very nature of wood tends to draw in moisture and dissolve iron materials, particularly when they are under water as these were.

I am enclosing the photographs numbers 1 and 2 and am sending along the samples which should be reasonably identifiable being in the original containers. I trust that this information will prove of some assistance to you.

Yours very truly,
THE STEEL COMPANY OF CANADA, LIMITED

A. B. Dove
Senior Development Metallurgist
Wire and Fastener Divisions

ABD/ST
Encl:
Copy to: [illegible] - Collier Associates

(26)

The Steel Company of Canada, Limited

STELCO

CANADA WORKS, Hamilton, Ontario.

March 30, 1971

The Oak Island Exploration
6200 Grande Allee
ST. HUBERT, P.Q.

ATTENTION: Mr. K. Ellard
Project Co-ordinator

Dear Mr. Ellard:

Further to our telephone conversation, I attach herewith details of the metallurgical examination of the pieces of chain, wire and laminated forms.

I trust this information will be useful. The remaining samples are returned herewith.

Yours very truly,
THE STEEL COMPANY OF CANADA, LIMITED

A. B. Dove
Senior Development Metallurgist
Wire and Fastener Divisions

ABD/ST
Att:

(27)

Oak Island Samples - Metallurgical Examination

1. Chain

Case hardened LC Steel 15/20 C. Case consists of very coarse untempered martensite. Further in towards core, martensite grains are surrounded by intergranular troostite. Core is pearlite with pro-eutectoid ferrite. Average case depth .020" and carbon penetration extends to a depth of about .040".

2. Wire Samples

Low carbon steel

Core consists of finely dispersed Fe_3C spheroids which are banded in the direction of drawing. Core matrix is ferrite. Wire has received a prolonged low temperature anneal. There is extensive ferrite grain growth at the surface of each sample. Surface quality is poor with rokes and seams but steel is relatively clear of non-metallic inclusions.

3. Flat Angular Section

Low carbon steel consists of angular ferrite matrix with some pearlite grains. Angularity of grains suggests cold working. Section contains huge voids and slag inclusions and is a generally dirty steel.

28

Discussion of Metallography

1. Chain

The treatment is archaic. It is characteristic of deeply case-hardened samples that cracking will occur under high surface stress, as in use in a chain. Chains are usually fire welded at the center of the curve. The structure indicates that the carburizing treatment was carried out after the chain was welded. When the surface was worn away, the chain abraided severely. The cleanliness of the steel indicates the possibility of use of Swedish steel. Until after 1747, the British Navy would not use English steels. The metal of the chain could be from before that time; the treatment would not likely be countenanced by later knowledge.

2. Wire Samples

Poor surface quality was probably due to early seamy rod production and poor wire lubrication. The structure is due to long slow heating and cooling as 1200°F to 1300°F. The steel is relatively free of dirt and inclusions, and could be again of Swedish steel, but the treatment could have occurred in any low carbon material - and wire has been drawn for nearly 10,000 years.

3. Angular Sections

These sections similar to the arrowhead-like piece are folded wrought iron, and were, in all probability, produced prior to 1750. Their purpose and use is not clear from samples submitted in present form.

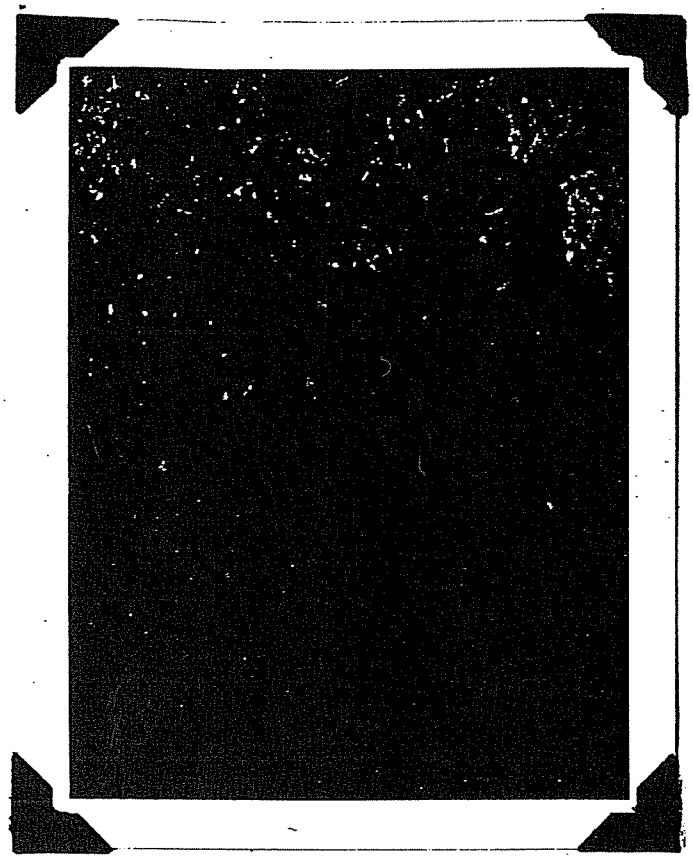


Photo 1 - Case Hardened Chain

Photo 2 - Metal Strapping

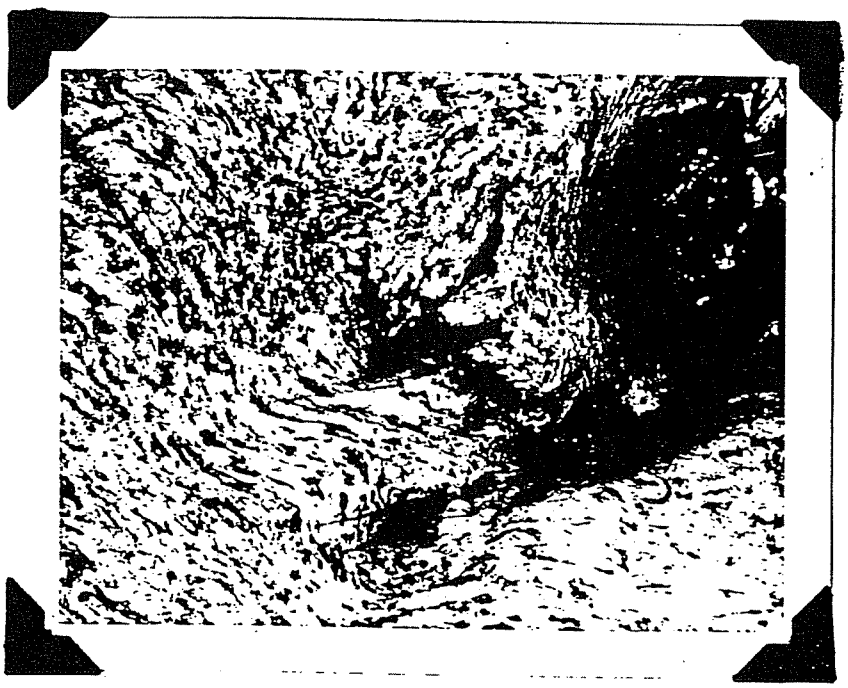


Photo 3 - Wire Samples

(30)

April 19th, 1971.

Mr. A.B. Dove,
Senior Development Metallurgist,
Wire & Fastener Division,
The Steel Company of Canada Limited,
Hamilton, Ontario.

Dear Mr. Dove:

As I mentioned on the phone, I am including the latest batch of samples from Oak Island for your assessment. The enclosed material falls into two principal categories:

a. Material recovered from below the 167 foot level in Borehole 10X.

b. Material found in the vicinity of an old warf located on the northwest corner of the island. The material from the northwest corner is identified as such.

Your theory that the bits of chain-like material might be part of a ship's rigging is an interesting one and I hope that the additional material I am sending you will enable you to reinforce your theory. One of the samples from Borehole 10X appears to be some sort of laminated material, but Dan Blankenship suggests a remote possibility that it is contamination from a large drum he is using as part of his system of sifting the drill tailings. You will probably be able to tell one way or the other in a few moments.

Once again, thank you for all your help. We look forward anxiously to hearing from you at your earliest convenience.

Yours faithfully,

Kerry Ellard
Project Co-ordinator

ke.hr

encls.

(CONSERVER CETTE COPIE POUR VOTRE CONTRÔLE - RETAIN THIS COPY FOR FOLLOW-UP)

31

ENVOYER À / SEND TO

DE / FROM: A.B. Deve/hr

SERVICE / DEPARTMENT:

Kerry Ellard

DATE: April 21st, 1971.

SUJET / SUBJECT:

MESSAGE

Report on Samples sent April 19th.

1. Chain: Put together by carburization, an old process known even to Egyptians. This process found to be metallurgically unsound. Material very brittle, cracked and poorly prepared.

2. Two pieces - old material prior to 1850 and possibly 1800. This is wrought iron, made of many laminations. Process not used for at least 100 years. Silicate slag all through material.

3. Pieces of wire - prior to 1850. 120 years ago, this process of manufacture stopped.

4. Strap attached to hunk. Hunk actually cement. Looks like type of cement previously made in Caribbean from sand and molasses or some type of sealing agent. Iron permeated entire mass, causing rust colour throughout. Course sea gravel stuck onto end of strap now with cement?.

5. Drift spike - Definitely wrought iron. Prior to 1850 and could be as far back to 1500. Positively more than 100 years old.

6. Metal? is definitely metal, could be part of casing.

Letter with complete details dictated, but not yet typed.

EMPLOYER LA PARTIE INFÉRIEURE POUR RÉPONDRE / USE LOWER PORTION FOR REPLY

RÉPONSE DE / REPLY FROM

DATE

POUR ENVOYER UN MESSAGE: ÉCRIRE LE MESSAGE À LA MAIN OU À LA MACHINE. EXTRAIRE LA COPIE JAUNE ET LA CONSERVER POUR CONTRÔLE. ENVOYER LES DEUX AUTRES FEUILLES SANS DÉTACHER LE TALON.

TO ORIGINATE: HAND OR TYPEWRITE MESSAGE. REMOVE YELLOW COPY (FOLLOW UP COPY) AND FORWARD BALANCE OF SET.

SPEEDIMEMO

POUR RÉPONDRE: ÉCRIRE SUR L'ORIGINAL, PUIS DÉTACHER LE TALO RENVOYER LA COPIE ROSE ET CONSERVER L'ORIGINAL POUR CONTRÔLE.

TO REPLY: WRITE REPLY, SNAP SET. RETAIN WHITE ORIGINAL AND RETUR PINK COPY.

– IL EST POSSIBLE D'UTILISER DES ENVELOPPES À FENÊTRE #9 OU #10 EN PLIANT LE "SPEEDIMEMO" AUX ENDROITS INDIQUÉS PAR DES FLÈCHES.
– SAVE ENVELOPE TYPING: FOLD FORM AT ARROWS FOR USE IN #9 OR #10 WINDOW ENVELOPE.

MOORE BUSINESS FORMS LTD. 050958 PAPER PAT'D BY N. C. R. C

(32)

The Steel Company of Canada, Limited

STELCO

CANADA WORKS, Hamilton 23, Ontario

April 22, 1971

The Oak Island Exploration
6200 Grande Allee
ST. HUBERT, Quebec

ATTENTION: Mr. K. Ellard
Project Co-ordinator

Dear Mr. Ellard:

In reference to our telephone conversation and the samples which arrived April 19th. Following is the assessment of the samples as I see it at this time.

Spike From Old Wharf at Northwest Corner of Island

This is presumably a drift spike used to hold timbers in place which had been produced by the blacksmith specifically for the purpose. This material is definitely of wrought iron and we do not need a metallurgical examination in order to indicate that this is true. This is certainly pre-1850 because while wrought iron was certainly used after that time, it would not exhibit the longitudinal striations as a result of corrosion indicated in this sample.

Unidentified Metal Strap from Northwest Corner

This is an interesting piece of slit strap; its use I could not possibly guess. It is, however, very old wrought iron and was produced by early-type rolling. I would suggest that it is probably pre-1800 and certainly pre-1850. The slag in the material is very extensive as seen in photograph no. 2. These are slag inclusions of silicates which are the result of the rolling and pounding which are part of the process of rolling wrought iron. The material is very low in carbon value and for this reason would not corrode away nearly as badly as a modern material immersed in water.

Metal? From Northwest Corner of Island

This is apparently a small casting. It is certainly metal, although it is now encrusted with sea gravel and other forms of contamination. I did not wish to break the piece and have not done so.

(33)

Metal Brought up from 198 Ft. - Borehole 10X

This material is wrought iron, probably from a thin plate or strap. The condition of the material would seem to indicate that it is very early material, certainly pre-1850 and possibly pre-1800.

Metal Strap Attached to Stone from Northwest Corner

The metal strap is the same as that shown in photo no. 2, being a wrought iron of rather early vintage. Its method of attachment to the stone was rather interesting to me though and I note that whatever form of cement was used, it was composed of sand, sea gravel and appeared very similar to the molasses cement which I have seen in the Caribbean. Nelson's frigate, for example, at Kingston, Jamaica was built entirely using a cement between the stone construction composed of molasses and sand. This appears to be very similar.

Metal from 175 - 198 Ft.

This is composed of pieces of chain and wire samples. The two welded pieces of chain were very interesting. They were fire welded and case hardened after welding. As I stated in my last letter on this subject, the material had been pack hardened after the chain was formed, and these cross links, that were provided in this case, just crossed over and fire welded were later completely case hardened in a packed furnace. The material in this particular case is not as clean as the sample examined last time, but the structure is very much the same and is shown in photo no. 1. You will see that the intergranular areas are heavily burnt and cracked due to overheating and very long firing during the hardening process. For this reason, the chain has broken up rather badly as you have seen in the number of small samples that have been exhibited here. It is natural that the stock is very brittle and would not stand a great deal of strain before it gave way, particularly if subjected to bending stress. The wire samples are not wrought iron, but a cemented steel and that it contains inclusions of such size as shown in photo no. 3 where you will see that the grain structure flows around the inclusions. This is characteristic of older pieces of metal and would not be expected, even in highly drawn material of this sort, in a modern steel. I therefore consider this material to be pre-1850 and possibly pre-1800.

I trust that this information will be of value to you. Your samples are being returned under separate cover. Kindest regards.

Yours very truly,
THE STEEL COMPANY OF CANADA, LIMITED

A. B. Dove
Senior Development Metallurgist
Wire and Fastener Divisions

ABD/ST
Att:

(34)

stelco

The Steel Company
of Canada, Limited

Canada Works
Hamilton 23, Ontario
(416) 528-2511

June 11, 1973.

Mr. D. Tobias,
Triton Alliance Limited,
6200 Grand Allee,
ST. HUBERT, Quebec.

Dear Mr. Tobias,

Confirming our telephone conversation of this morning. The small sample is returned, herewith. About 1/4" was removed for metallographic examination and the results of that examination are as follows:-

Analysis:	Low carbon, approximately 0.05-0.08%.
Structure:	Fine-grained, equiaxed core, cold-worked periphery at shallow depth, in which structure is heavily worked. Depth of work cannot be ascertained due to corrosion. Some slivery areas filled with fire oxides. Inclusions are presumed to be Manganese sulphides and oxides, with fine cementitic oxides within the grains rather than at boundaries.
Conclusions:	Low carbon iron which has been subjected to frequent heat treatments with low degree of cold work. Surface breakage and reduction areas indicate small drafts with poor lubricants and rather primitive die designs - probably in the 1500's to 1800's. This is not a residual "cutting" product, but is part of a corroded low carbon material which had been drawn by cold-working.

If I can be of further assistance, please advise. Kind regards.

Yours very truly,
THE STEEL COMPANY OF CANADA, LIMITED

A. B. Dove.
Senior Development Metallurgist
Wire and Fastener Division

ABD/ms
Enc.

X778A

copy to Mr. D. C. Blankenship,
Oak Island Motel,

(35)

CANADA CEMENT LAFARGE LTD.
606 CATHCART, MONTREAL 111, QUE.

March 14, 1977

Mr. David C. Tobias, President
Jonergin Co. Inc
6200 Grande-Allee
St Hubert, P.Q.
J3Y 186

Dear Mr. Tobias:

This will acknowledge your letter of February 11 and the samples of excavated material from Oak Island. These have been subjected to examination and testing at our Belleville Research Laboratory with results as shown in the attached report.

Although it is difficult to be absolutely sure, it is likely that these materials reflect human activity involving crude lime but not Portland cement. These conclusions are based on the preponderence of calcite ($CaCO_3$) in the 1 cm thick paste of Sample #1 and the extreme fineness of the calcite crystals. Dr. Chen considers that the calcite, if naturally occurring, would consist of much larger crustals. Furthermore, the presence of rust at a flat surface as in Sample #2, indicates contact with a man-made iron object.

I trust you will find these observations useful.

Yours very truly,

W. S. Weaver
Manager of Research
and Quality Control

WSW:js

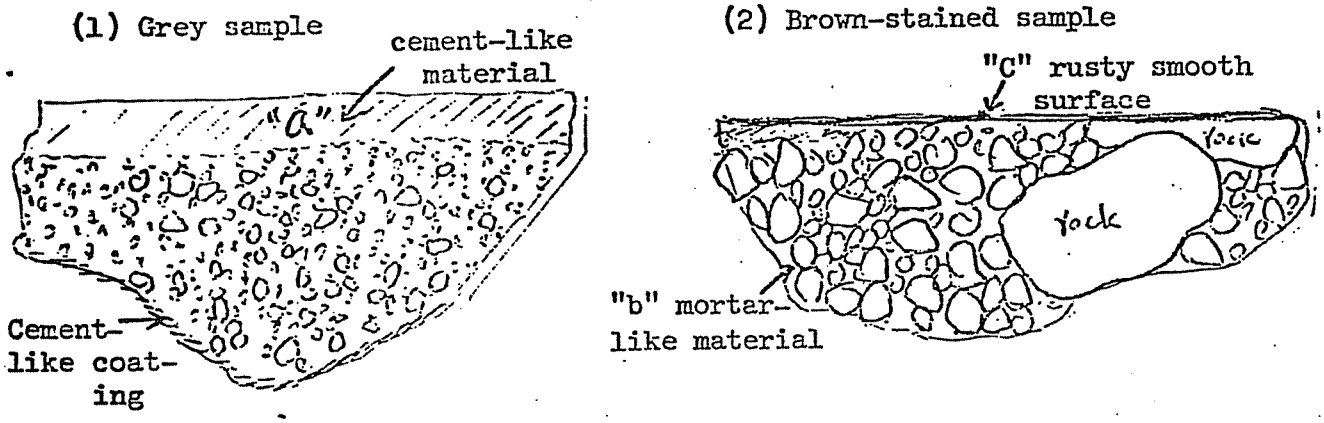
P.S. The Laboratory has retained portions of Samples #1 and #2. Please advise if you wish to have these returned.

PROJECT 20722

OAK ISLAND SAMPLES

I. Sample Description and Subsample Preparation

Two samples received are sketched as follows:



Sample #1 had a layer of soft material which appeared like Portland cement paste; this was designated 'Sample A'. The rest of the sample consisted of coarse sand with a matrix of the same kind of grey material.

Sample #2 contained coarser aggregate with very lean mortar-like material as matrix. The fine fraction of this 'mortar' (-45 μm) was designated 'Sample B'. Most of Sample #2 was brown stained. A portion of rusty material was scrapped off the smooth surface of #2 sample and analyzed as 'Sample 'C'.

II. Examination by X-ray Diffraction, Microscopy and Thermal Analysis

Subsample A

Subsample A contained 68% calcite; the balance consisted of quartz, micas (muscovite and biotite), feldspar, chlorite, amphibole, magnetite, and dolomite. The concentration of quartz was not high; grain size was mostly smaller than 50 μm. Calcite grains were even finer — mostly smaller than 25 μm. Judging from the concentration and size of quartz grains, this subsample was not a mortar but more likely a hydrated lime which was completely carbonated. The fine size of calcite grains would suggest that it was not naturally occurring. It is likely that the lime was burned from limestone which contained quartz and other materials as impurities.

(37)

Subsample B

Subsample B contained 28% calcite; the balance consisted of the same other minerals as in Subsample A and some amorphous Fe_2O_3. This subsample was more like a mortar than a paste. It contained coarse sand and had to be ground and sieved to concentrate the cementitious material but there was still high concentrations of quartz, feldspar, chlorite, micas, magnetite, amphibole, and dolomite, originating from the 'aggregate'. Because of the low concentration of calcite and the grinding of the sample, it is more difficult in this case to determine whether the calcite was natural or artificial. Clay and sand both may contain appreciable quantities of calcite.

Subsample C

Subsample C was just like rust. It contained mainly amorphous Fe_2O_3 and iron hydroxide, $Fe(OH)_3$. Minor compounds found were calcite, quartz, chlorite, micas, feldspar and dolomite. It appeared that the flat surface of Sample #2 had been in contact with some iron material.

March 11, 1977

Hung Chen