

Searching for the Source of the Titanic Headstones in Halifax

T-0 Update

April 15, 2012



D. Barrie Clarke
Department of Earth Sciences
Dalhousie University
Halifax, Nova Scotia B3H 4R2
clarke@dal.ca

Executive Summary

The 150 gravestones in three Halifax cemeteries for victims of the sinking of the Titanic consist of an identical homogeneous gabbro. Historical records (newspaper articles, archival records, shipping records, cargo manifests, trade journals) yield few clues as to the origin of these gravestones, meaning that the search for the source must be a scientific/petrological one. Any candidate source pluton must match the *mineralogy – texture – composition – age* of the Titanic gravestones. The primary *mineralogy* of the headstones is: plagioclase-olivine-orthopyroxene-clinopyroxene-hornblende-biotite-titanomagnetite-apatite-zircon, with secondary sericite-uralite-chlorite. The *texture* is medium-grained and intergranular. The *chemical composition* (majors, traces, REEs) is as yet undetermined. The *age* from biotite is ~455 Ma and from zircon is ~422 Ma.

The supplier of the Titanic headstones almost certainly had to be: 1. already in operation in 1912; 2. able to supply a large order in less than six months; 3. well known to the Board of Directors of the White Star Line; and 4. perhaps close to WSL headquarters in Liverpool (therefore, either Scotland or Ireland). Although the mineralogy-texture-composition-age of the Titanic headstones must match the quarry from which they were extracted, the quarry may have long since gone out of operation. More importantly, in terms of a search strategy, the Titanic headstones should, in most cases, match other material that was extracted from the quarry about the same time (1910-1915) and is now locally displayed near the quarry in buildings, pavements, and monuments.



James Cameron, the famous Canadian film director, denies knowing about the existence of this Halifax headstone before giving a name to the fictitious lead character in “Titanic”.

Introduction

In three Halifax cemeteries are buried 150 victims of the sinking of the Titanic. Their headstones were supplied by the White Star Line and were in place about seven months after the disaster. All the headstones are the same material, a medium-grained, dark gabbro with plagioclase, olivine, orthopyroxene, clinopyroxene, hornblende, biotite, titanomagnetite, and apatite as the main primary minerals. We think the age of this rock is 422-455 million years old. For practical and historical reasons, we are trying to locate the quarry where this material was extracted one hundred years ago.

An historical search of newspaper articles from 1912, shipping records, White Star Line archives, and trade journals has turned up no information. So the search has become a scientific one, an exercise in forensic petrology, and clearly these headstones must match rocks in the source quarry, wherever that may be.



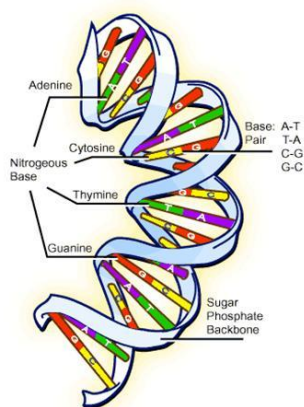
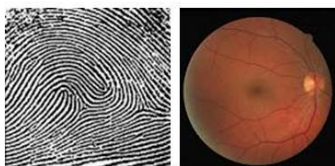
Some of the Titanic headstones in Fairview Lawn Cemetery, Halifax

The Principle of Petrological DNA

Petrology is the science of rocks. Every igneous rock has an *absolutely unique* set of **mineralogical-textural-chemical-geochronological** properties. There are approximately 20 common rock-forming **minerals**. Which ones of these 20 are present in any given rock, and the proportions of each mineral (called modal abundances) are essentially infinitely variable. The sizes and shapes of the minerals, and the way in which they grow together in a 3-D jigsaw puzzle fashion is called the **texture** of the rock. Clearly the texture is also infinitely variable. Furthermore, each mineral has a fairly well-defined **chemical** composition, but is commonly highly variable within defined limits. Thus each mineral has its own chemical fingerprint, and the aggregate of the minerals, the rock itself, also has a distinct chemical composition. Finally, in **geochronological** terms, each igneous rock contains a variety of radioactive isotopes (e.g., ^{40}K , ^{235}U , ^{238}U , ^{232}Th , ^{87}Rb , ^{147}Sm) that decay at known rates (clocks in rocks), and these clocks allow us to determine the time in geological history when the rock formed. Collectively, this set of **mineralogical-textural-chemical-geochronological** properties is as unique to an igneous rock as DNA is to biological material. It follows that the *entire* petrological DNA of the Titanic headstones *must* match the *entire* petrological DNA of the parent quarry from which the headstone material was extracted. Partial matches are not acceptable.

Uniqueness

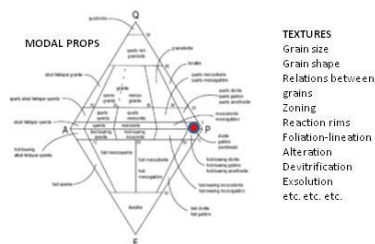
Biology



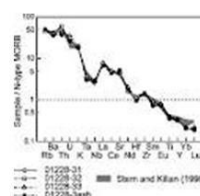
Commerce



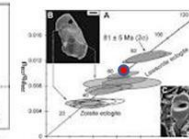
Petrology



GEOCHEMISTRY



RADIOMETRIC AGE



Fingerprints, retinal scans, and DNA in biology, bar codes and QR codes in commerce, and mineralogy, texture, chemical composition, and age in rocks are all unique identifiers.

Titanic Headstone Mineralogy

The principal primary minerals of the Titanic gravestones are plagioclase feldspar and clinopyroxene, fitting the scientific definition of a gabbro. Unusual for many gabbros, this rock also contains four other dark coloured ferromagnesian minerals (olivine, orthopyroxene, hornblende, and biotite). We might modify the rock name to call it an olivine-bearing noritic gabbro. Other primary minerals include titanomagnetite, apatite that is orange under catholuminescence, and trace amounts of zircon. Secondary minerals include sericite, uralite, and chlorite. This assemblage and proportion of minerals is unique to the Titanic headstones and must match rocks in the quarry from which they were extracted.

More detailed electron microprobe work needs to be done on the Titanic headstone material, but a preliminary comparison of the mineral compositions with the Northeast Grampian Basic Suite from Scotland shows a good match with the Inch gabbro (olivine, plagioclase, orthopyroxene, and clinopyroxene), but no match whatsoever with the Morven Cabrach gabbro.

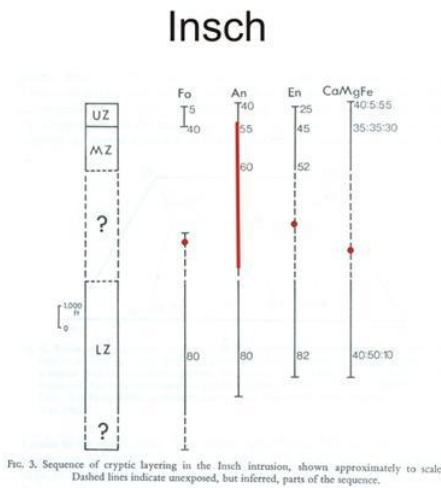


FIG. 3. Sequence of cryptic layering in the Inch intrusion, shown approximately to scale. Dashed lines indicate unexposed, but inferred, parts of the sequence.

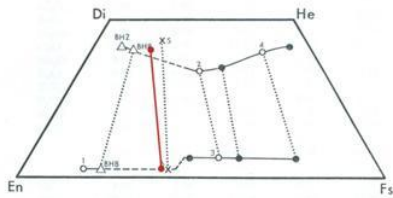


FIG. 4. Pyroxene crystallisation trends for Inch Layered Series and associated rocks. Open circles refer to analysed pyroxenes from the Layered Series and the crosses to analysed pyroxenes from a typical granular hypersthene-gabbro; the numbers refer to the analyses in Table 1. Filled circles refer to optical determinations, and the triangles to pyroxenes from the Belhelvie intrusion, believed to be equivalent to the Inch Lower Zone; BH numbers refer to analyses in Wadsworth et al. 1966.

Morven Cabrach

TABLE 4
Summary of rocks and mineral compositions

	45	?	p.	77	p.	SYENOGABBRO (NORTHERN)
	40-36	(33)	p.	92	p.	SYENOGABBRO (SOUTHERN)
NORTH	42 (Z: 45-40)	?	p.		(p.)	QUARTZ-MICA-DIORITE
	57-54 (Z: 60-55)	52-50	p.		(p.)	QUARTZ-BIOTITE-NORITE
	57-55	50	p.		(p.)	HYPERSTHENE GABBRO
	57-55		p.	55-56		NORTHERN FERROGABBRO
	58-55	50-46	$Co_{42}Mg_{33}Fe_{21}$			NORITE
	57-54	50		55-57		SOUTHERN FERROGABBRO
SOUTH	58-54	49				NORITE
	All TITANIC minerals less differentiated!					
	Plagioclase An%	Orthopyroxene En%	Clinopyroxene	Olivine Fo%	Apatite	

Full lines: Identifiably cumulus minerals.
Broken lines: Identifiably intercumulus minerals.
(Z:): zoning
*By chemical analysis from rock no. 9 existing with En₄₈

p.: present
(): present in small amounts

More detailed microprobe work will follow when we have a potential match based on textural and chronological criteria.

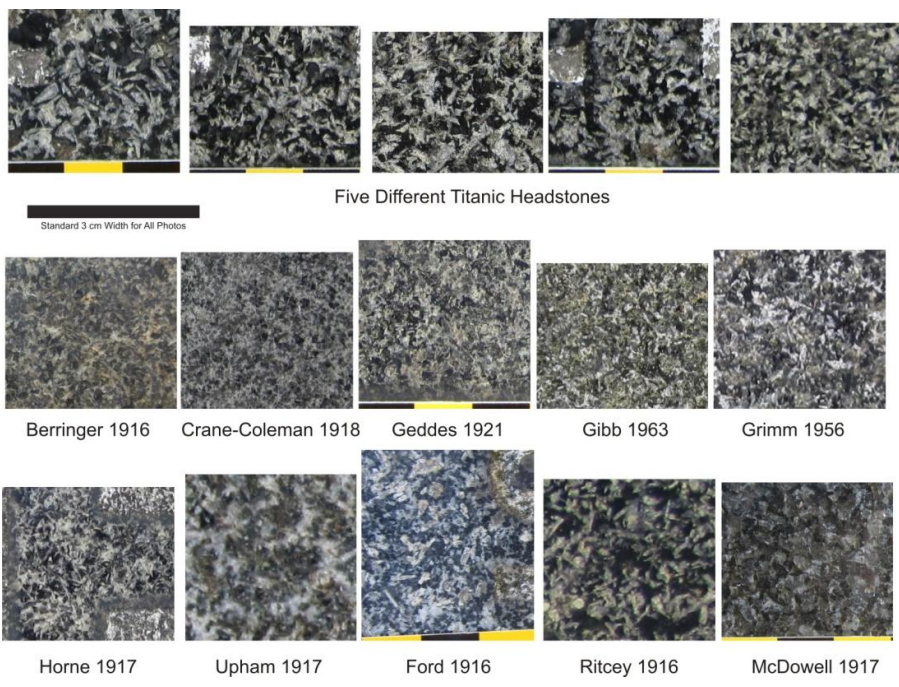
Titanic Headstone Texture

Macroscopic

Compared with many common gabbroic (“black granite”) tombstones in cemeteries, the Titanic gravestones are fortunately rather distinctive macroscopically. The two images below show the cut-and-polished (left) and cut-and-unpolished (right) surfaces of the Titanic headstones.



The composite figure below shows a random collection of five Titanic headstones across the top, compared with ten other so-called “black granite” headstones in Fairview Lawn Cemetery. One of those other ten is a good macroscopic textural match for the Titanic stones. Can you see it? Furthermore, that matching headstone is the same size and shape as the Titanic headstones, and was probably a left-over stone from the Titanic batch. In fact, one unusually large Titanic stone is granite, so this later one may have been originally intended for that person.



This little exercise shows that we can only be confident in a textural match if we can see the materials side-by-side, both polished, and both at the same scale. It also demonstrates, once again, that the human brain is a highly effective pattern-recognition and picture-matching machine, and that the texture, quantitatively and qualitatively, will be a crucial criterion in the eventual match.

In this quest to find the source of the Titanic gravestones, it would be ideal to be able to compare polished apples only with polished apples. Having seen only the Titanic rock in roughly cut or cut-and-polished surfaces, I am not at all confident that I would recognize the Titanic headstone in a weathered or even fresh outcrop quarry. The best hand specimen match I have seen so far is from the Haddo House gabbro from Aberdeenshire (images below) located by Malcolm Hole of Aberdeen University. You be the judge – is either of these the same rock as on the previous page?

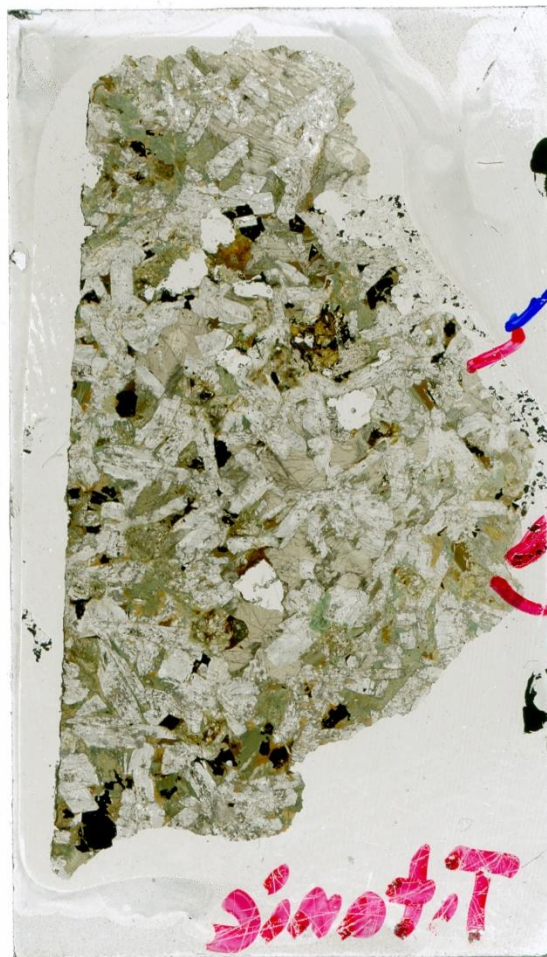


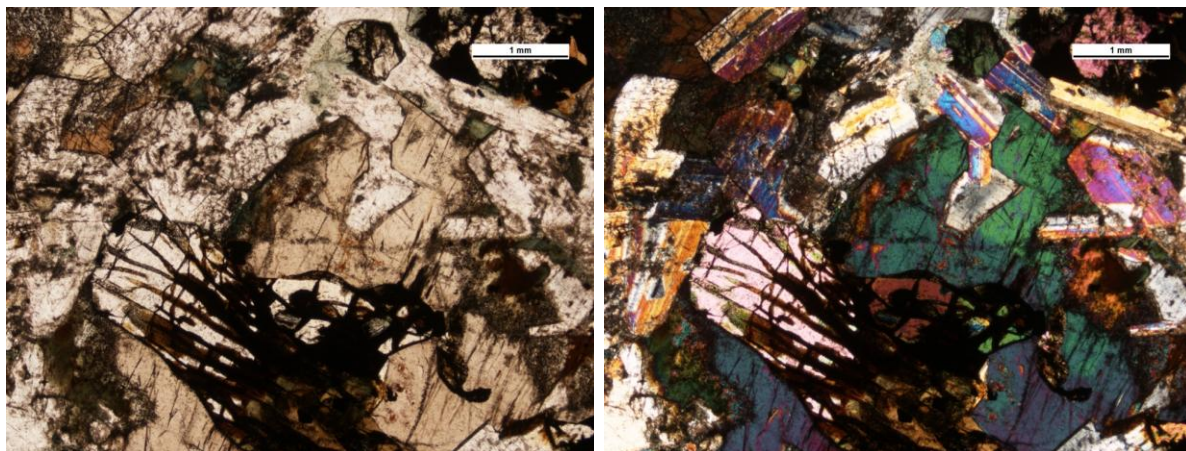
However, as noted by Malcolm, the Titanic material has less hornblende, has less well developed reaction rims around the ferromagnesian minerals, and is more strongly altered than the Haddo House material, so the match is not as good at the microscopic level.

Titanic Headstone Texture

Microscopic

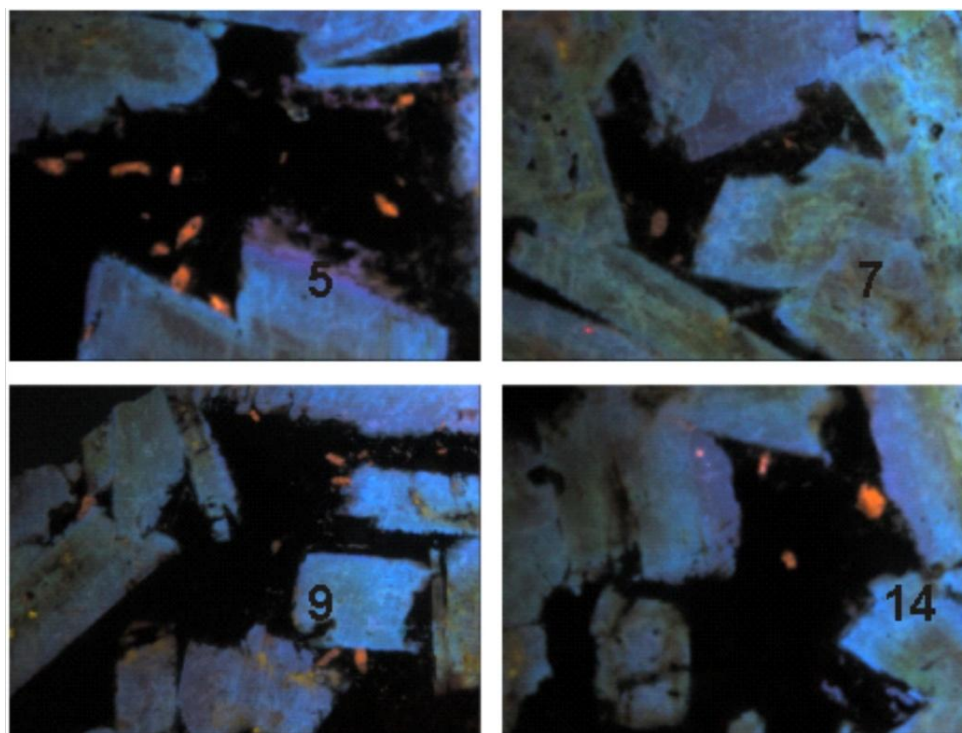
Below are two scans of two standard 45-mm-long thin sections in scattered light. What stands out are the randomly oriented plagioclase grains, the light brown clinopyroxene occupying interstitial positions between the plagioclases, the green hornblende and patchy uralitic alteration, and the opaque titanomagnetite.





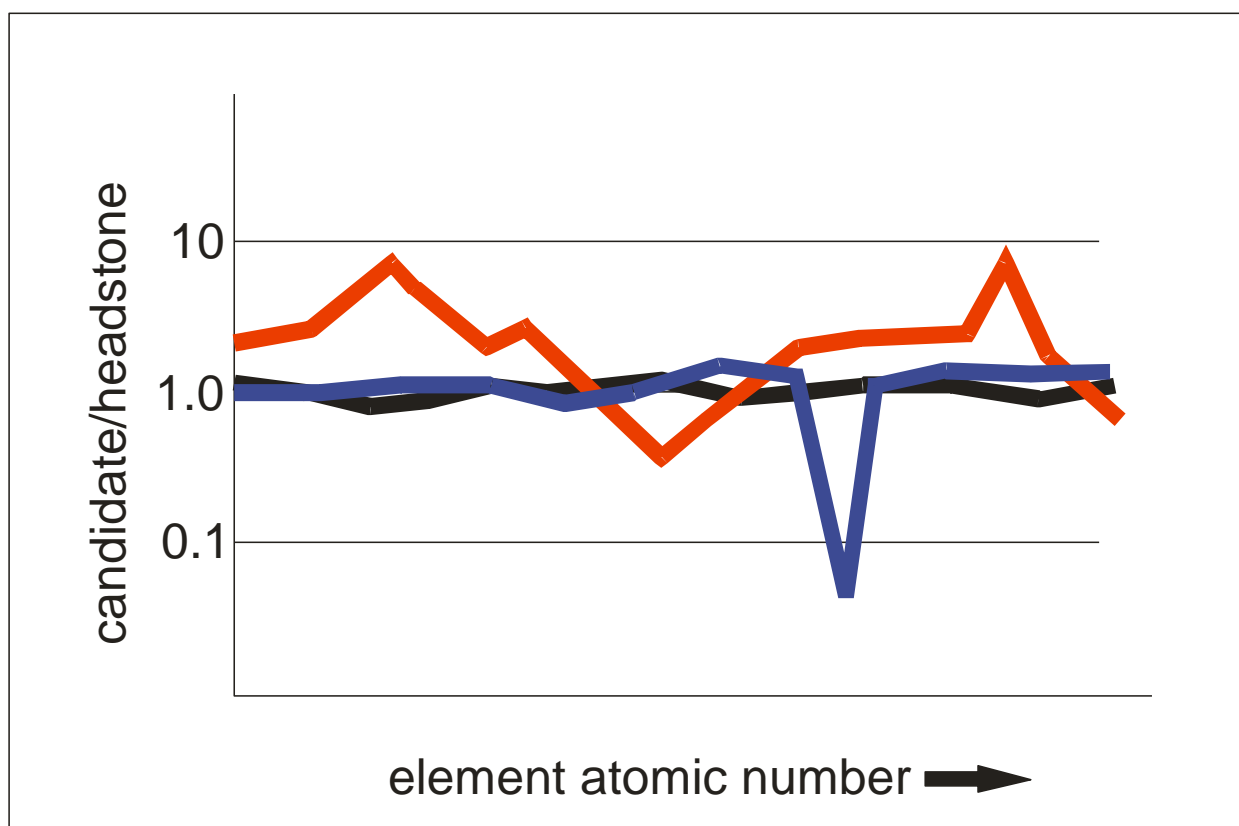
The two images above show the same view of the Titanic gabbro in plane polarized light (left) and crossed polarized light (right). A large (pink in XPL) olivine grain lies in the lower left quadrant. The scale bar is 1 mm long.

The images below show four views of the Titanic gabbro under cathodoluminescence – the ferromagnesian minerals are black, the plagioclase grains are blue, and the apatite grains are orange. Many gabbros I know have rather prominent apatite grains, but these ones are small and are buried in the ferromagnesian minerals. This microscopic texture should also be a diagnostic characteristic of this rock material. The width of each image is approximately 3 mm.



Titanic Headstone Bulk Chemical Composition

At the present time, we do not have the bulk chemical composition of the headstone rock material. If/when we are able to acquire some more headstone material, and if/when we have a candidate target quarry, then we will analyze both the headstone and candidate materials *in the same laboratory at the same time* so there are no inter-laboratory differences. Then the simplest way to compare the two materials is to divide the candidate composition, element for element, by the headstone composition. If the ratio of candidate/headstone is approximately unity, the candidate is a good match; if any element ratios depart significantly from unity, the candidate is not a good match.



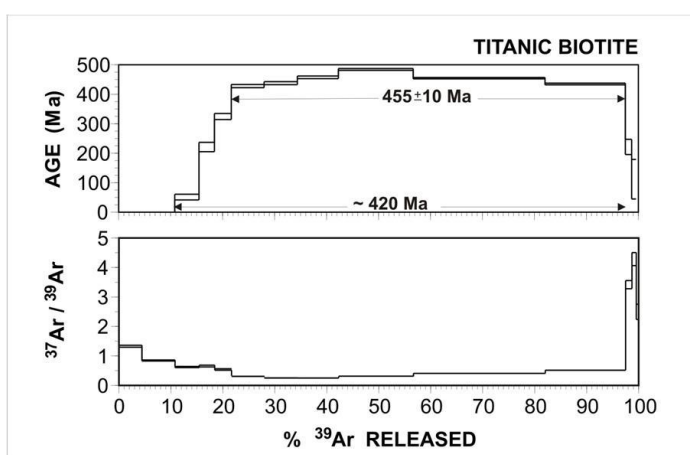
In this so-called spider diagram, the black candidate is a good match, the red candidate is an unacceptable match, and the blue candidate is a good match for all but one chemical element.

Titanic Headstone Radiometric Age

Many minerals have the potential to act as atomic clocks. Some of these mineral clocks are more reliable than others for telling geological time. At this point in our investigation, we have only two clocks and two ages that do not agree very well on how old the headstones are.

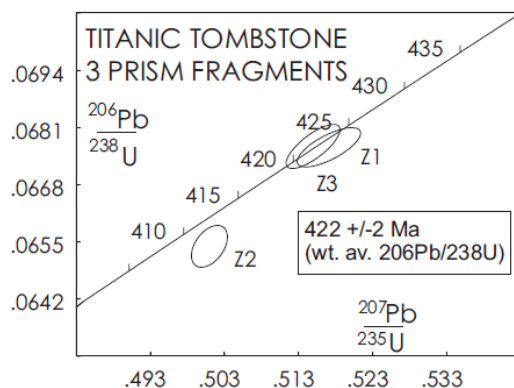
The Biotite Clock

Peter Reynolds of Dalhousie University has used the decay of radioactive potassium (^{40}K) in biotite to measure the age of the Titanic headstones. His best determination of their plateau age is 455 ± 10 Ma, similar to the 462 ± 10 Ma biotite ages from the NE Basic Suite of Aberdeenshire.



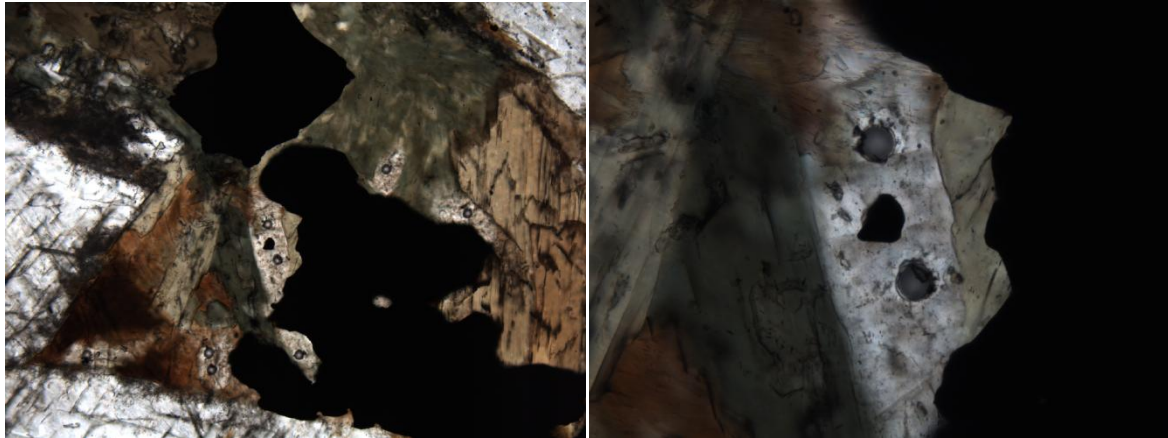
The Zircon Clock

Greg Dunning of Memorial University has used the decay of radioactive uranium (^{235}U and ^{238}U) in tiny grains of zircon to measure the age of the Titanic headstones. His best determination of their age is 422 ± 2 Ma. This age is similar to the appinite suite of Scotland and Ireland, and similar also to many gabbros in the northeastern Appalachians.



The Apatite Clock

Dan Kontak of Laurentian University has attempted to use the decay of radioactive uranium in those tiny grains of apatite to measure the age of the Titanic headstones. Unfortunately the levels of common lead are too high to permit a determination of their age.



Laser ablation pits (~25-30 μm in diameter) in apatite grains in the Titanic headstone gabbro.

So what does all this geochronology mean? The good news is that material from the source quarry must also show the same discrepancies in age between its biotite and zircon, and have the same problem with common lead in its apatite. These disparate characteristics of each mineral then become an important part of the geochronological DNA of the Titanic headstones. The bad news is that, although the biotite age agrees with biotite ages from the NE Basic Suite in Aberdeenshire, if the Titanic headstone zircon age represents the intrusion age, the zircon ages from Aberdeenshire gabbros are 470 Ma. There is a ~420 Ma intrusive event in NE Scotland, but to the best of anyone's knowledge, all those intrusions are granites, but could there be an undated gabbro among them? Otherwise, the 422 Ma age is similar to that of the apatites of Scotland and Ireland, but so far these rocks have not received much attention in our search.

The Principle of Search Area Reduction

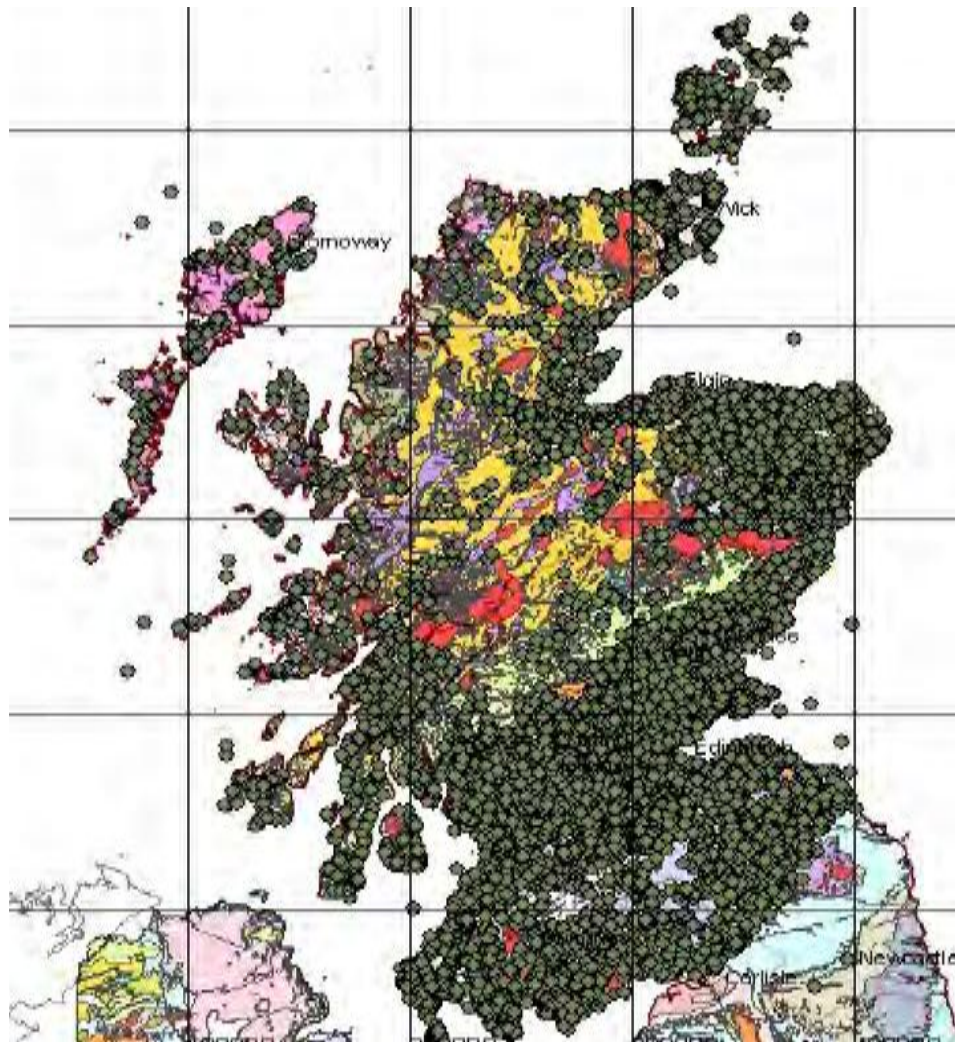
Clearly, there is no point in searching for the target source quarry at random in southern Saskatchewan or on the island of Barbados, two of the many places on Earth where gabbros do not occur. Instead, we use geological maps for likely source areas on either side of the Atlantic, and circle all the gabbros. More specifically, we circle all the gabbros with the right geological age (420-455 Ma). And then we reduce that number by rejecting all those that do not have five ferromagnesian minerals. And then we further reduce the number only to those known to have been quarried a hundred years ago. Of course, the source quarry might have been in another part of the world altogether, but the fact that the headstones arrived in Halifax six months after the Titanic sank suggests that the supply line was (relatively) short. However, places such as Sweden, Germany, South Africa, and even India cannot be ruled out by this supply-line criterion alone. According to Ted Nield, the UK annually imported hundreds of tons of dimension stone from India in the early 20th Century. Finally, it is certainly true today but even a hundred years ago, a supplier of dimension stone was not necessarily the source of the stone.

The Principle of Target Expansion

The general search strategy is that each of the mineralogical-textural-chemical-geochronological characteristics of the headstones will serve to narrow the search. Ultimately all of the petrological DNA must match. But the source quarry is such a small target (a few hectares), and it may have been out of operation for decades and completely grown over by vegetation or used as a landfill. In addition, the Titanic headstones were quarried in 1912, a time when almost all commerce was done locally – commerce then was the opposite of globalization – it was the ultimate in localization. Each community had its own dairy/creamery, its own foundry, its own grain, vegetable, and fruit production, its own supply of meat, and probably its own quarries for building materials. (As evidence of this localization, the map of quarries in Scotland on the next page is essentially the map of Scotland.) Some materials, especially heavy ones such rocks, other than in exceptional circumstances, were not normally transported very far, the cost of transportation being greater than the intrinsic value of the material. There are always exceptions. Watson (1911) reported that the Herrestad gabbro quarry in Sweden regularly sent material to Aberdeen for finishing and export on to “America”. Quarries in South Africa and India may have done the same thing.

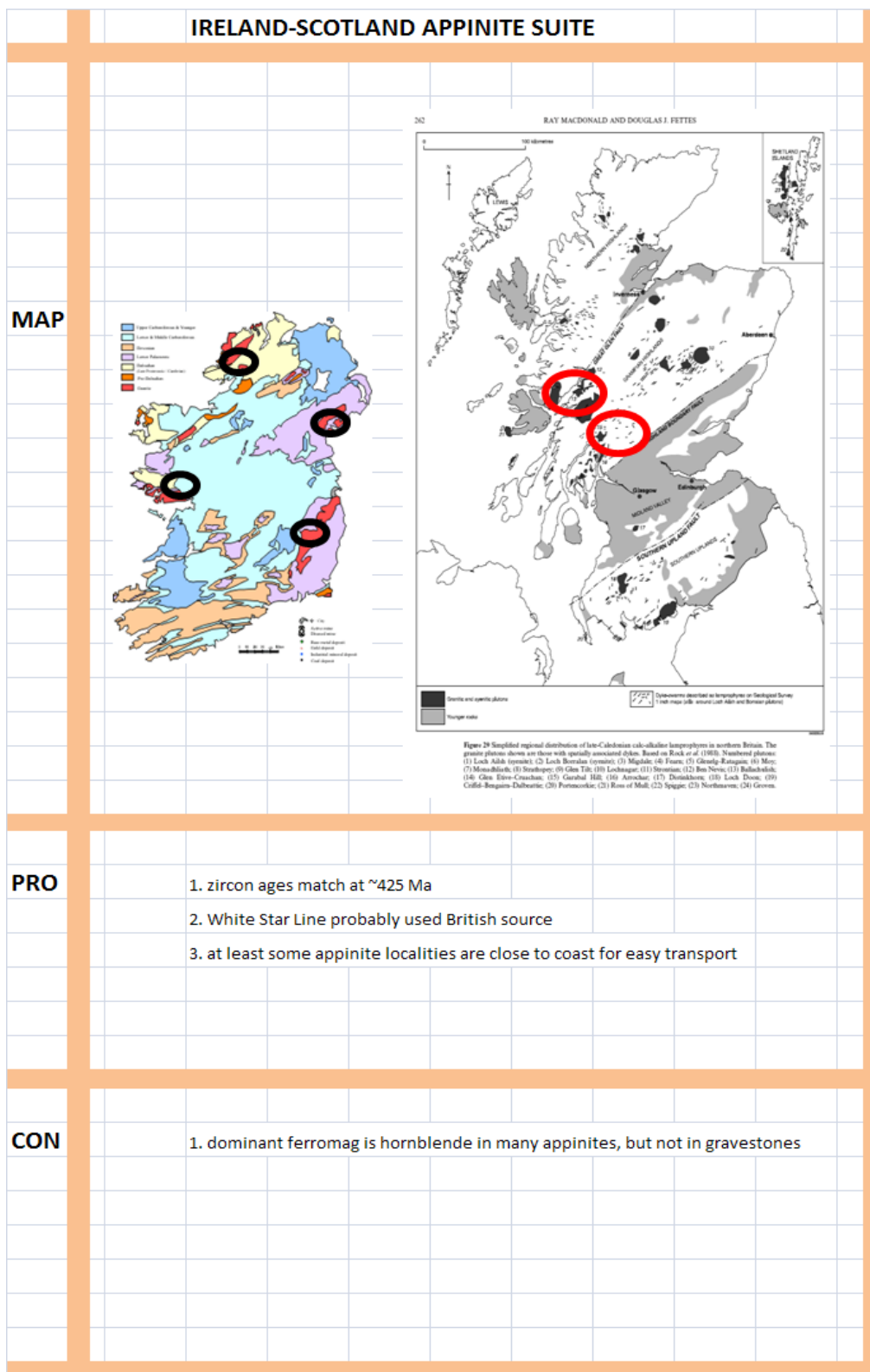
So, although it may be very difficult to find the quarry itself, it should be easier to find this target expanded by the prominent installation of its stone nearby. The Titanic headstone material is anomalous in the Fairview Lawn Cemetery, but it should be common in cemeteries and on buildings near the target quarry. That source quarry must have been in full operation in

mid-1912 and must have been able to supply a large order for 150 headstones in a short time. Almost certainly that quarry did not provide a one-time-only order for the White Star Line and then shut down. It will be much easier to recognize polished material near the source quarry because all we have for comparison are the polished stones in Halifax. So, as long as the supplier is the source, rather than look for weathered or even fresh material in some perhaps long-abandoned quarry, the search strategy should be to examine every black rock on buildings, on pavements, on curbstones, and in cemeteries in areas where gabbroic rocks are known to occur. (As noted above, this strategy may not work if the source quarry, wherever it was, essentially supplied an export market.)



The map of quarries in Scotland is essentially the map of Scotland. Source: Colin Tennant

Appinites of Ireland and Scotland



Northeast Basic Suite of Scotland

NORTHEASTERN GRAMPIAN BASIC SUITE	
<p>MAP</p>	<p>RAY MACDONALD AND DOUGLAS J. FETTES</p> <p>Devonian and younger sedimentary rocks</p> <p>Silurian to Early Devonian granitic intrusive rocks</p> <p>Ordovician granitic intrusive rocks</p> <p>Ordovician basic and ultramafic intrusive rocks</p> <p>Dalradian metasedimentary rocks</p> <p>major fault</p> <p>shear zone</p> <p>0 kilometres 10</p>
<p>PRO</p>	<ol style="list-style-type: none"> 1. long history of quarrying in Aberdeenshire 2. good petrological match (oliv-opx-cpx-hbl-biot) 3. biotite ages match at 455-465 Ma 4. Rob Raeside's recollection of having been in Titanic quarry 5. White Star Line probably used British source 6. Haddo House owned by GG of Canada in 1890s
<p>CON</p>	<ol style="list-style-type: none"> 1. zircon age mismatch (gabbros 470 Ma, headstones 422 Ma)

Conclusion

Most of the evidence so far is of the negative/exclusionary variety, but even that type of evidence is useful if it serves to reduce the size of the search area. Occasionally, we have had strong evidence pointing in one direction, e.g., the biotite ages of 455 ± 10 Ma, the recollection of Rob Raeside that he had been in the Titanic quarry long ago as a student (p. 28), and the Haddo House samples all point to Aberdeenshire. But the normally reliable zircon age of 422 ± 2 Ma suggests that we should be looking elsewhere. "Elsewhere" could be anywhere on this planet, although the Appalachian-Caledonian orogenic belt is the first choice in terms of proximity to White Star's headquarters and/or Halifax's burial location.

Alas, we have now officially missed the 100th anniversary of the *sinking of the Titanic*, and all the high-profile publicity that goes along with it, but the 100th anniversary of the *erecting of the headstones* is not until November 6th of this year, so we still have a few more months to search. And even if we miss that anniversary, the solution to this problem in forensic petrology is worth pursuing as long as it takes. After all, the inspirational Helge Ingstad (1899-2001) did not set an artificial time limit, nor did he quit, in his ultimately successful search for Vinland (i.e., L'Anse aux Meadows, the only authenticated Viking site in North America), nor should we abandon our search for the source of the Titanic gravestones until we find it.

Future Plans

1. Acquire more headstone material from Maritime Museum of the Atlantic.
2. Make more polished thins and search for *in situ* zircons to date by LAM-ICPMS.
3. Conduct more cemetery surveys in high probability source areas.
4. Do whole-rock geochem and confirmatory geochron on any good min-text matches.
5. Write a proper scientific paper on forensic igneous petrology when we find a match.
6. Release findings to print and electronic media when we find a match.
7. Share entire file with all interested persons and institutions contributing to this work.

Appendix 1

Assorted Notes from On-Line and Geographic Searching

General On-Line Searching

In 2012, one might reasonably assume that *everything* one needs to know is somewhere on the Internet. Indeed, there are many, many commercial and scientific websites devoted to dimension stones. One of these websites may indeed show the Titanic material, but I haven't recognized it yet. One of the best general commercial on-line dimension stone sites is:

<http://www.graniteland.com>

Its extensive database is searchable by colour (e.g., black) and/or composition (e.g., gabbro), but for some reason I can't copy the pictures from the website to put them in this report, so check out these ones:

<http://www.graniteland.com/stone/charcoal-black>

<http://www.graniteland.com/stone/grandee-lio>

<http://www.graniteland.com/stone/sora>

Practically every city has one or more vendors of granite countertops. I have looked at many of their websites, without any success but a few of them have been interesting. For example,

<http://www.royalwooddesign.com>

shows a collage of dimension stones. Look below at the third row, fourth sample from the left (enlarge the image on your computer screen if necessary). This company has not replied to my inquiries.



Geographical Searching

The current primary search area extends from northwestern Europe to northeastern North America. The following is a rather inhomogeneous collection of notes arranged from east to west.

Sweden

The Watson (1911) publication refers to the Herrestad metagabbro that was quarried and shipped to Aberdeen for processing and export to “America”, but unfortunately its age appears to be 1570 Ma!



Germany

Axel Renno and Jochen Stein in Germany have given some thought to this question, but like the rest of us, have not been able to find a solution. Below is one website and one possible sample.

<http://www.stonecontact.com/stone-Valtengrund-Gabbro.htm>



Scotland

The publication of “British and Foreign Building Stones” by John Watson in 1911 is extremely timely in terms of searching for a source of stone quarried in 1912. Actual standardized samples of the some 600 building stones he describes are housed in the Sedgwick Museum at Cambridge University. Marian Holness and Dan Pemberton are currently checking out six potential gabbro samples in that collection. Otherwise, the following are several excellent websites describing dimension stone in Scotland:

<http://www.bgs.ac.uk/mineralsuk/mines/stones/home.html>

<http://www.scotland.gov.uk/Publications/2007/06/04121227/1>

<http://geoscenic.bgs.ac.uk/asset-bank/action/viewHome>

Northern Ireland also has an excellent searchable dimension stone database on-line:

<http://www.stonedatabase.com>



I’m not sure what this column is, but the so-called “Belfast Black” dimension stone actually comes from South Africa!

Republic of Ireland

I am really short on comprehensive information on dimension stone in Ireland.

<http://www.mhti.com/mineinventory.htm>

but Brian McConnell has commented that most gabbros of the appropriate age in Ireland are either strongly metamorphosed and foliated (such as Connemara), or are faulted and altered (such as the small bodies of gabbro in SE Ireland). Not too promising.

General Reference for Canada

The Granite Industry of Canada by C. F. Carr (Dept. of Mines and Technical Surveys, Mines Branch No. 846) 1955

Newfoundland and Labrador

The provincial website for dimension stone is:

<http://www.nr.gov.nl.ca/mines&en/geosurvey/dimension/>

And an excellent starting point is:

http://www.nr.gov.nl.ca/mines&en/geosurvey/publications/openfiles/OF_Nfld2865.pdf

Lawson Dickson of the provincial Geological Survey noted that our 422 Ma zircon age on the Titanic headstones is the same as the gabbro from the Mt. Peyton bimodal suite in Central Newfoundland but, unlike the Titanic headstones, there is virtually no alteration in the Mt. Peyton gabbro. Furthermore, there is no history of monument-stone quarrying of gabbro in Newfoundland prior to the mid 1980s.

According to Greg Dunning, there is also a post-tectonic bimodal dyke swarm at 422 ± 2 Ma in Notre Dame Bay. This magmatism in NL is quite distinctive with fresh mafic minerals and cutting all major penetrative fabrics in older rocks. Not checked out yet.

Nova Scotia

A timely publication on dimension stones in Nova Scotia is that of Wm. A. Parks (1916) "Report of the Building and Ornamental Stones of Canada". The most recent publication (1989):

<http://www.gov.ns.ca/natr/meb/pdf/is19.asp>

shows the so-called "Dawn Black Granite" from Erinville, looking quite unlike the Titanic headstones.

Northern Nova Scotia /Cape Breton Island (Avalon and Other Lithotectonic Terranes)

Consultations with Sandra Barr have not turned up any gabbroic candidates in northern Nova Scotia or Cape Breton Island. I still need to consult with Georgia Pe-Piper and David Piper.

Southern Nova Scotia (Meguma Lithotectonic Zone)

Gabbros have been quarried in the Shelburne area of southwestern Nova Scotia, but these mafic rocks show magma mingling textures with the 380 Ma granites and are, therefore, too young to chronologically match the Titanic headstones. Although it has been suggested that the West Erinville gabbro is the source for the Titanic headstones, I have examined a sample from the dimension stone collection at NSDNR, two samples in the possession of Chris White, and

some thin sections in the possession of Sandra Barr but none seems to be a textural match. Furthermore, the U-Pb zircon age of the Erinville gabbros is 389 Ma, and no one is aware of any older gabbroic rocks in the Meguma Lithotectonic Zone of Nova Scotia. Thus the most likely source region for the Titanic headstones geographically is also the most unlikely source geochronologically.

New Brunswick

The St. Stephen gabbro, on the border with Maine, shows an enormous range of textures and compositions, none of which seems to match the Titanic headstones. I have consulted with Sandra Barr and looked at dozens of her hand samples from the St. Stephen gabbro without any success.

Susan Johnson of the Department of Natural Resources has also thought about this problem. She notes that the headstone zircon age of 422 Ma is the same as gabbros from the St. Stephen-St. George and Bocabec areas. She sent me a pdf of an old NB government publication by Gwen L. Martin entitled "For Love of Stone Volume 1.: The Story of New Brunswick's Building Stone Industry", an historical account of the building stone industry. There certainly were "black granite" quarries operating in the St. Stephen-St. George area in the late 1800s and early 1900s. What the publication indicates is that:

Bocabec

Spinney Quarry – not opened until 1930s

Stuart Quarry – operating in 1898, but little activity after that time

Bayside Quarries – operated between 1917 and 1937

St. Stephen

The Ledge – described as a dark grey granite and operations were “well under way” in 1911 - many of the stones can be seen today in buildings and curbstones in St. Stephen – may be worth checking out.

Maine

General dimension stone references include:

<http://www.maine.gov/doc/nrimc/mgs/explore/mining/sites/aug03.htm>

and

<http://www.maine.gov/doc/nrimc/mgs/explore/mining/sites/jan07.htm>

Steve Haynes of the Maine Granite Industry Museum on Mount Desert Island has a life-long connection with the granite industry in Maine, including “black granite”. I have corresponded extensively with him, but he has not been able to match the Titanic headstones with anything he knows in Maine.

The following list contains specific suggestions, almost verbatim, from Dan Lux for our consideration:

Bodwell Black Granite Quarry - Vinalhaven Maine - described as an olivine norite, black in color, fine texture, with hypersthene, olivine, biotite and magnetite .

Black Diamond Black Granite Quarry - Addison Maine. Hypersthene gabbro. Very dark gray with fine to medium ophitic texture. Brown cpx. But the petrographic description mentions quartz.

Hall Black Granite Quarry - Calais - Norite of brilliant luster and very dark gray. Coarse texture. Brief description mentions hypersthene and biotite

Heal Black Granite Quarry - Lincolnville - Olivine Norite - black shade, medium texture, contains olivine, hornblende, hypersthene, biotite - mentions alteration chlorite and serpentine

McConchie Black Granite Quarry - St George, Tenants harbor - Norite with magnetite of a very dark shade, hypersthene.

Mingo, Bailey and Co. Black Granite Quarry - Calais - Norite of almost black color, fine to medium-grained texture - mentions hypersthene.

Pleasant River Black Granite Quarry - Addison - Hypersthene, olivine gabbro of almost black shade - medium ophitic texture, biotite, hypersthene, and greenish olivine.

Thornberg Black Granite Quarry - Addison - hypersthene gabbro of almost black shade, medium ophitic texture - None of these quarries are active but there are location maps. I’m not sure about the ages of the Heal or McConchie gabbro, but all of the others are possible based on age.

Source: Maine Geological Survey Minerals Resources Index No. 2, 1958, Maine Granite Quarries and Prospects, apparently by John Rand.

The Addison quarries are in the Pleasant Bay gabbro, the Bodwell in the Vinalhaven Gabbros, and the Calais quarries in the Moosehorn Gabbro, I am unfamiliar with the Lincolnville and St George quarries.

Vermont

Malcolm Hole first broached the possibility of Vermont as a source for the Titanic headstones, and Don Bowes suggested that I contact Snow's Funeral Home here in Halifax, the very same company contracted by the White Star Line in 1912 to bury the victims. I spoke to Graham Murphy at Snow's about this question, and within hours, he got back to me with word-of-mouth information that the Vermont Marble Company may have supplied the headstone material; however, Paul Thompson, of the Vermont Granite and Marble Company, does not recognize our headstone material. Meanwhile, his and several other websites show something called Impala or Rustenburg Black Granite, but it comes from South Africa and, if it is part of the Bushveld intrusion, appears to be > 2000 Ma old. Paul Thompson suggests contacting the Rock of Ages company in Barre, Vermont. Round and round we go!



Impala Black Granite
(compare with images on p. 6)



Rustenburg (= Impala) Black Granite

Appendix 2

Non-Geological Searching

Because the event commemorated by the Halifax headstones occurred only 100 years ago, there should be good written records of the transactions (orders placed, invoices, shipping bills of lading, etc.), but if there are, we have not found them. Are the records simply lost, or have we not been looking in the right places, or does it mean that the White Star Line imposed a confidentiality agreement on the supplier?

Below is at least a partial list of the kinds of searches that have already been done (my apologies to anyone whose contribution is left out):

Alan Ruffman in Halifax has searched newspaper articles, shipping records, archival records, and trade journals for information, learning only that the White Star Line placed the order and paid for the Halifax headstones, and that the stones arrived in Halifax about seven months after the sinking of the Titanic.

Jenny Brown in Aberdeen has gone through the minutes of the Aberdeen Granite Association for 1912, but she can find no mention at of the Titanic at all in the minutes for that year, nor any reference that might imply a large order shared among local granite yards.

Colin Milne has checked that the one Titanic victim (James Lee Fraser) buried in Aberdeen does not have the same headstone as the Titanic victims in Halifax, whatever that may mean.

June Ellner has checked the various lists and catalogues to the archival material within the holdings of the University of Aberdeen library and has also looked at the published volumes in their Local Collection on the history of local granite firms and quarries, but has found nothing specifically mentioning a shipment of granite to Halifax in 1912.

There is also what we might refer to as the oral tradition. For instance, Rob Raeside of Acadia University remembers being told by Professor Ian Munro of Aberdeen University in 1973 that the gabbro quarry in which they stood during a class field trip was the source of the Titanic headstones. On the other hand, Malcolm Hole checked with Prof. Nigel Trewin, and he has no recollection of any association with Aberdeenshire gabbro and Titanic, but remembers that Ian Munro was not one for making unsubstantiated comments. Rob Raeside is not able to recall the precise location of that quarry, only that it was close to Aberdeen. The problem is that our zircon age does not match the gabbros of Aberdeenshire. Also, there is a prominent Titanic memorial in Liverpool, checked out by Peter Kokelaar, but it is made of granite that came from the Rubislaw Quarry in Aberdeenshire, successfully tracked down by Emily Tracey:

<http://www.scottish-places.info/features/featurefirst1485.html>

Nevertheless, if that type of information has survived in human memory for 100 years, then there must be other people who are likewise carrying around in their brain cells the information we want to know. Bill Allan is a member of the Aberdeen and Northeast of Scotland Family History Society, and he has written a piece for their April 2012 newsletter in the hope that there are others who may have had ancestors who worked in the quarry to supply the Halifax headstones and passed that knowledge down to their descendants. After all, the sinking of the Titanic was the 9/11 of 1912, and anything to do with that disaster would have attracted attention. Alan Ruffman estimated that the total weight of the Titanic headstones is about 12 metric tonnes. The placement of a single order for 150 headstones was so unusual that it could only have been for some major disaster, and the only one in everyone's mind was the Titanic. Alternatively, I suppose, that order was only a minor part of the business of some huge source quarry, and that particular order for the WSL passed more or less unnoticed.



One last look – this picture should print close to true scale.