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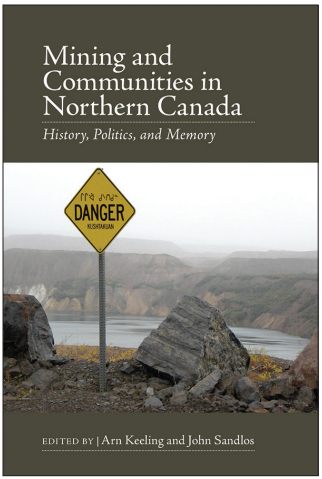

MINING AND COMMUNITIES IN NORTHERN CANADA: HISTORY, POLITICS, AND MEMORY

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Contesting Closure: Science, Politics, and Community Responses to Closing the Nanisivik Mine, Nunavut

Scott Midgley

Hit by a decline in the price of zinc and with a looming deadline to pay millions of dollars for an annual order of sealift supplies, the Nanisivik lead-zinc mine on north Baffin Island closed in 2002 after twenty-six years of successful operation. News of Nanisivik's closure was delivered by Nunavut's territorial newspaper *Nunatsiaq News* with the morose headline "Nanisivik Mine to Die Four Years Early."[1] Similarly, some community members viewed Nanisivik as a deceased entity, eulogizing the personified Nanisivik during public meetings:

> In some ways, it's sad for me because it was a town for a long time, and we were working there, and we were friends with the people that I worked with, and Inuit from our communities were there too. And when you, one of your family members dies, it looks like you're losing some of your family members even the

> non-Inuit there were — they too were your friends . . . It was emotional for me that I could still feel the life in that building.[2]

These statements mirrored classic narratives of mine closure that often consider ruination and dereliction as inevitable, in what some scholars call the "mining imaginary": the idea that mining is a linear process that must naturally terminate in ecological destruction and economic devastation.[3] In its productive phase, the Nanisivik mine extracted ores as well as economic value. Once the mine's operation halted, it seemed, the mine had died. The mine was no longer productive; the ore deposit was no longer valuable.

While acknowledging that ore deposits are finite resources and mines must inevitably close, this chapter encourages a different reading of Nanisivik's closure that moves away from the "mining imaginary." Rather than suggesting that the Nanisivik mine became an unproductive, lifeless, and valueless site after its closure, this chapter builds on arguments developed by geographers and historians such as Ben Marsh, William Wyckoff, and David Robertson who suggest that mining communities, memories, and legacies persist long after mining activity formally ends.[4] While analyses of industrial development and resource exploitation by scholars in fields such as resource geography often investigate how natural resources are culturally produced within particular socio-technical arrangements and historical-geographical circumstances,[5] these literatures focus on resource production rather than post-production when these arrangements and circumstances shift. Yet focusing on the process of closure itself reveals ways in which former sites of commodity production—their communities, economies, and environments—continue to be negotiated and transformed by numerous actors and reclamation practices in ways that upset the mining imaginary. Mine closure is a time when the history of a mine resurfaces, and the landscape, already transformed by mining, is remade again by closure and reclamation activities.

This chapter examines the ways in which Nanisivik's closed mining landscape became an object of experimentation, subjected to scientific activities that extracted environmental data from the mine site, produced scientific knowledge, and valued the cost of reclamation amid attempts to offset the environmental impacts of mining. Through an analysis of

historic and contemporary documentary evidence relating to Nanisivik's opening and closure, this chapter first briefly introduces the history of mine development at Nanisivik and describes some of the impacts of mining on the nearby community of Arctic Bay. In a critique of the mining imaginary, the next section explains how the mine company CanZinco attempted to cast the closed Nanisivik townsite as a valuable and useful site. The final section examines how the cost of reclamation was valued and contested by various parties during the reclamation of the tailings at Nanisivik. In particular, this final section argues that these debates involved generating objective, authoritative, and neutral knowledge to legitimize different claims about the environment and verify contesting valuations of the cost of reclamation. Far from an unproductive, valueless, or lifeless space after closure, this chapter outlines the ongoing but different ways Nanisivik continued to be productive after the mine's operations ceased.

NANISIVIK'S DEVELOPMENT AND COMMUNITY RESPONSES TO CLOSURE

Located 750 kilometres north of the Arctic Circle, the Nanisivik lead-zinc mine opened by Mineral Resources International (MRI) was the first mine north of the Arctic Circle and the northernmost mine in Canada at the time of its establishment in 1976. The Nanisivik site was comprised of a purpose-built town with a school, church, post office, recreational centre, dining hall, nearby airstrip, and dock constructed on Strathcona Sound, approximately twenty-five kilometres from the Inuit community of Arctic Bay. Nanisivik's infrastructure was partially financed by the federal government in the hope that this experimental project would test the feasibility of operating in the High Arctic and pave the way for expanded mining across Canada's northern resource frontier. As the vice president of CanZinco Ltd. (then-current owner of the Nanisivik property) explained in one public hearing:

> . . . one of the visions was that this would be a pilot project. It may not be successful, but if it was, what a wonderful way to

> find out if we could do natural resource exploitation in the north. In 2007, there was $1-and-a-half billion that came through the north in mining, and Nanisivik was the first one north of the Arctic Circle and a pioneer breaking the way for all those others that have followed.[6]

As this quote suggests, government support of the Nanisivik venture was not driven by profitability alone, but also various social and political objectives. In particular, the government "saw benefit in the [Nanisivik] project as a 'pioneer project' that without setting precedents might enable large scale experimentation in Arctic mining techniques and transportation."[7] Like previous Inuit employment projects at the Rankin Inlet nickel mine (see Keeling and Boulter, this volume) and at DEW (Distant Early Warning) line stations, the government hoped that Nanisivik would introduce some Inuit residents in the Baffin region to wage labour in an industrial setting.

To ensure the success of Nanisivik, the federal government entered into the Strathcona Agreement with MRI in 1974, signed by the minister of Indian Affairs and Northern Development, the president of MRI, and a local witness by the name of I. Attagutsiak.[8] Under the agreement, the government invested $18.3 million into townsite, dock, and airstrip development in return for an 18 per cent stake in the company and representation on the company's board of directors.[9] For its part, MRI pledged compliance with the government's social, environmental, and economic objectives for the North. One key objective of the Strathcona Agreement was ensuring that Inuit workers comprised 60 per cent of the workforce at Nanisivik. The agreement also sought to minimize the environmental impacts of mining through environmental studies and reclamation activities.[10] Other conditions of the Strathcona Agreement included:

> Provisions of vocational training for northern residents, comprehensive environmental studies and planning, preference for the use of Canadian material and equipment and Canadian shipping, company exploration programs to increase ore reserves and possible further processing of mine concentrates in Canada.[11]

Deemed a progressive and unprecedented approach to northern resource development, the agreement clearly sought to enact the government's commitment to the well-being of northerners and "optimize experience and benefits obtainable from this pilot Arctic mining venture."[12]

This experiment proved successful from the point of view of the government and mine company: the Nanisivik mine operated profitably for twenty-six years until its closure in 2002 and typically employed a workforce of two hundred people. In line with the mining imaginary, CanZinco's Vice President of Environment and Sustainability Bob Carreau presented closure as an inevitable stage in the life course of the mine, albeit with a notably positive spin:

> Unlike many businesses where closure often means failure, closure of a mine is, in fact, a measure of success. It means that you have gone through all the stages of a mine, and you have reached closure and reclamation, at least a plan in closure and reclamation. If you didn't do that, you would be doing abandonment, and that's not the case with Nanisivik. We have reached this final stage, closure and reclamation, it is a measure of success . . . Now, as we enter the final stage of the project, we culminate the success with the closure of the mine and the townsite. Closing a mine is never a happy event. And in the case of Nanisivik where this means the community will cease to exist, it is that much harder. However, as stated at the outset of this introduction, the closure of the mine is inevitable, and planned reclamation, it is the final milestone of that achievement.[13]

In spite of these proclamations that Nanisivik had succeeded as a pilot project, the mine failed to achieve its target of a 60 per cent Inuit workforce. Instead, typically only 20 to 25 per cent of the workforce was Inuit, a figure that dropped to 9 per cent in the final years of the mine's operation.[14] The failure to employ higher levels of Inuit labour led consultants Hickling-Partners to conclude in one report that "the mine has not succeeded in the role for which it was intended—as an experimental prototype."[15]

For the community of Arctic Bay, the mine's closure left behind many uncertainties: no one knew whether other economic activities could be

undertaken at Nanisivik, and concerns grew over the environmental impacts of mining (such as soil and water contamination and the disposal of tailings waste). In public meetings, community members expressed concern about the destiny of the Nanisivik townsite, the level of community involvement in reclamation activities, and the impacts of mining on local wildlife and the land upon which the Inuit depended for hunting. Kunuk Oyukuluk explained in one public hearing how wildlife had been impacted by mining at Nanisivik:

> In early spring, when it was still March or May, when there is still ice, they would break the ice. And because it is our wildlife area—and so my concern is that seals, we rely on the seal meat; and they have a breeding ground on the ice, that the ship went through the breeding ground of the seals. And in July when Arctic Bay residents were out Norwhale [narwhal] hunting, the ship also went through the hunting ground, the hunting area. And during the Norwhale hunting, Norwhales would be scattered away by the ship. So every year they did that through the ice . . . So I need more help so that our generation— next generation, that they will have to have food to eat. And because we were brought up from the country food, so—and they are best food and makes you stronger, and we will be weaker population on other kinds of food.[16]

In a similar narrative, Moses Akumalik described how this environmental change impacted traditional lifestyles:

> I'm not trying to look big but we were living off the land when we were young. Now children when they grow up will lean more towards the civilized life as opposed to the nomadic life. In 1978, the ships would come in to load concentrate and they break the ice. Hunters lost their machines that were on the ice. That's why I'm asking for compensation because there have been impacts . . . They should thank the community for supporting their mining activity for all those years. A public apology with a thank you in money would be good. More than 20 skidoos were lost and all of their hunting equipment.[17]

As this quote suggests, some community members raised concerns regarding the cultural and environmental impacts of mining and requested an apology from the mine company. Additionally Mucktar Akumalik described how, despite co-operating with the mine, the community had been detrimentally affected by it, and he called for the community of Arctic Bay to be compensated:

> I want some kind of an apology, I guess, from the company because they did—they did their own activity without considering what the Arctic Bay community wants. And, you know, they didn't even ask the community how they feel about their activity, whether to, you know—Arctic Bay residents were concerned that—they were anxious for an apology, I guess, and they all just leave the area without apologizing to us.[18]

While some community members requested monetary compensation, others called for compensation in the form of old furnishings and equipment from the Nanisivik townsite or employment in future reclamation activities. In whatever form, these requests embodied appeals for justice: justice for harming the land, justice for impacting hunting activities, and justice for failing to reach Inuit employment targets.

NEGOTIATING CLOSURE AND RECLAMATION AT NANISIVIK

Community appeals for justice, inclusion, and empowerment during the closure of the Nanisivik mine reflected, in part at least, a dramatic change in the political context between the founding and closure of the mine. With the creation of "the new territory of Nunavut and, with it, the expectation that Inuit would become the managers of their own destiny," Inuit awareness of what power they could exercise increased significantly in the period leading to the closure of the mine.[19] In addition, the newly formed Government of Nunavut was cognizant that many mining companies had, in the past, abandoned northern mining projects without dealing with the environmental impacts of these activities, and was conscious that the livelihoods of Aboriginal northerners had been severely

affected by changes to the environments on which they depend. As such, the "Mine Site Reclamation Policy for Nunavut" attempted to empower northern communities and provide "the Inuit a 'clean slate' to develop the kind of resource management regime they want to take with them into the new millennium."[20]

Whereas the costs associated with environmental degradation had been largely externalized by mine companies and paid by the government in the past, the "Mine Site Reclamation Policy" applied the "polluter pays" principle, enforceable through security bond arrangements written into water licences, land leases, and other regulatory instruments. At Nanisivik, this meant that a water licence administered by the Nunavut Water Board (NWB) set the terms of reclamation, and the board assumed the primary responsibility for regulating and enforcing reclamation efforts. As part of the security bond arrangements, CanZinco, the NWB, and other intervening parties present at public hearings had to agree on the value of the bond, based on the projected costs of reclamation. In addition, as part of their commitment to forge a positive legacy for this Arctic experiment, CanZinco and the Government of Nunavut worked with the community of Arctic Bay to produce the "Closure and Reclamation Plan" for Nanisivik.

Newspaper stories documenting this process reveal something intriguing about Nanisivik's closure: while the mine had closed and its production had stopped, Nanisivik continued to be valued, but these valuations were contested by CanZinco, the government, and the community.[21] These valuations were estimates of the cost of reclamation, specifically, the amount that would be held in a security bond to ensure that CanZinco completed Nanisivik's reclamation in line with the "Mine Site Reclamation Policy for Nunavut." Huge valuations were suggested (and contested) by each party: initially, Indian and Northern Affairs Canada (INAC) suggested that reclamation would cost $27,536,028, while CanZinco's consultants estimated reclamation would cost $9,224,608, a figure almost three times lower than the INAC estimate.[22]

Two interesting features of this valuation process unsettle the notion that mining landscapes are devalued after their closure. First, as payee of the cost of reclamation, CanZinco attempted to inscribe the Nanisivik townsite with value. The importance of the Nanisivik townsite—as

a potential cost to CanZinco if it had to be destroyed due to contamination—was evident through CanZinco's attempts to attribute a high economic value to the site in order to offset the costs of reclamation. CanZinco commissioned an engineering firm in Toronto that estimated that it would cost more than $100 million to rebuild Nanisivik.[23] Declaring that "we have long taken and continue to take the view that it would be a tragedy if this facility were destroyed as part of the reclamation exercise,"[24] CanZinco worked hard to find future uses for the infrastructure, and undertook negotiations with companies interested in Nanisivik's production assets. CanZinco believed that given the "sheer number of companies currently exploring for diamonds within the immediate vicinity of Nanisivik . . . it would be foolhardy to destroy the existing industrial complex . . . when such a complex may serve as an inducement to one or more of these companies to establish a base at Nanisivik."[25] CanZinco eventually sold the mill, concentrate storage facility, power generation installation, conveyors, and ship-loading equipment to Wolfden Resources (owners of a property in Nunavut), who, in return, performed environmental cleanup in the area of the mill and storage facilities.[26] CanZinco's efforts to recoup monetary value from the closed townsite and mine illustrates how some of Nanisivik's infrastructure continued to possess both use-value and exchange-value after the mine's closure.

A second key feature of the closure process is the way that scientific knowledge was produced and mobilized to legitimate particular valuations of the cost of reclamation. A proliferation of studies undertaken by government scientists—and more frequently scientists, engineers, and technical consultants working for private environmental consulting firms—sought to provide an authoritative basis for resolving the dispute over the cost of reclamation. For CanZinco, this scientific knowledge was important in determining the amount of money the company would have to pay for reclamation. Consequently, both the government and CanZinco hired their own scientific experts to ensure that the knowledge produced was accurate and rigorous. These studies examined the extent of soil contamination, tested the stability and impact of tailings, contributed to various environmental site assessments and the Human Health

and Ecological Risk Assessment (HHERA), and measured the level of contamination of the townsite infrastructure.[27]

Studies on soil contamination were among some of the most important in determining the cost of reclamation, as well as some of the most contentious, because establishing the level of contamination was decisive in determining whether the townsite would be destroyed. In one study, the Government of Nunavut hired consultants EBA Engineering to conduct a soil-sampling program to determine the extent of contamination at Nanisivik—research that cost over $49,000.[28] Because of the high costs involved in destroying a townsite due to contamination, CanZinco also hired privately owned environmental consulting firm Lorax Environmental Services. Lorax observed the work of EBA, and represented CanZinco's interests through collecting duplicate samples following the same methodology as EBA.[29] The economic importance of these study results is evident in a letter written by CanZinco disputing reports that surface soils at the Nanisivik townsite were "toxic."[30] In this letter to the NWB, CanZinco asserted:

> The parties realized that there would have to be some amount of clean up performed at the Nanisivik townsite before the transfer of infrastructure assets from CanZinco to the GN [Government of Nunavut] could be completed. It is hoped, though, that the introduction of the word "toxicity" (by all accounts an inaccurate inference) has not derailed those discussions and caused irreparable harm and considerable expense to CanZinco Ltd. It is also hoped that the use of the word can be put in its proper context and that before becoming unduly alarmed the Ecological and Human Health Risk Assessment (which the group correctly points out was proposed by CanZinco Ltd.) is allowed to serve its designed purpose—to provide concrete information from which to act in a reasonable manner.[31]

In this letter, branding soil at Nanisivik as toxic represented a "considerable expense to CanZinco" because it raised reclamation costs while threatening to devalue the townsite, worth up to $100 million in CanZinco's eyes. Producing and legitimizing scientific evidence, then,

was critical for CanZinco to finalize the cost of reclamation and the value of its property at the site.

Together, these two features illustrate how CanZinco mobilized a counter-discourse to the "mining imaginary." Although Nanisivik was no longer a site for the production of valuable ores (and in fact, the site was a financial liability for the mine company), CanZinco cast Nanisivik as a useful and valuable site while subduing claims regarding the severity of contamination of the town. Furthermore, the Nanisivik minescape had become a space of intensive scientific investigation as soil samples were collected, water quality monitoring stations were established, and various field projects were initiated in order to legitimize different valuations of the cost of reclamation. However, as the next section will argue, these valuations were contested by the community of Arctic Bay and other intervenors, and the authority of scientific knowledge itself came under scrutiny.

THE SCIENCE AND POLITICS OF NANISIVIK'S TAILINGS COVER

The depth of an engineered tailings cover was perhaps the most contentious issue during Nanisivik's reclamation, and an issue that demonstrates how the scientific knowledge-making central to determining the cost of reclamation at Nanisivik was contested. The tailings at Nanisivik were the material by-product from the extraction and transformation of ores into lead-zinc concentrates. Within these tailings, *Thiobacillus* bacteria catalyzed the transformation of reactive sulphide minerals to generate outflows of acidic water containing high concentrations of heavy metals, in a process known as acid mine drainage. Even long after mining, these tailings continued to produce acid mine drainage—described as "poison water"[32] by the community—that the community and the government viewed as harmful to the surrounding environment. For instance, Elder Leah Oqallak commented in two public hearings, "So snow bunting, little bird landed on the tailings and it died right away, and it got—I got scared that I saw the bird die, so that's why it is my big concern."[33]

As part of progressive reclamation efforts undertaken during Nanisivik's operation, a field-monitoring program from 1990 investigated how acid mine drainage could be mitigated. Research conducted on behalf of Nanisivik mines indicated that *Thiobacillus* bacteria catalyzed the production of metals at a slower rate at lower temperatures.[34] The field-monitoring program sought to test the optimum conditions under which freeze-up of the tailings would occur using "test cell" covers.[35] Shale covers were constructed of varying levels of compaction and saturation, with thermocouples and frost gauges used to monitor temperatures. It was hoped that constructing a cover over the tailings at Nanisivik would thermally insulate the exposed tailings and promote freeze-up.[36] Once incorporated into the permafrost regime, these freezing conditions would reduce oxygen diffusion to make contaminants inert, preventing the contamination of surface water.[37] The extreme Arctic climate thus offered a "natural" method by which acid mine drainage could be prevented; in the words of CanZinco, this "reclamation work [was] focused on utilising the natural conditions to provide for the secure, long-term closure of the mine."[38]

Data from this field monitoring program, in combination with other studies conducted during the closure of the mine, were critical to informing the design of the engineered cover that would limit acid mine drainage. Data collected by CanZinco indicated that test cell 1, constructed from shale without compaction or saturation, had an average thaw depth of 0.92 metres.[39] To ensure that the tailings would remain frozen even under worst-case climate warming scenarios, geothermal models predicted thaw of 1.0 metres in a one-year period in the event of an extreme weather scenario (1-in-100 year warm event) and thaw of 1.22 metres at the end of one hundred years under a global warming scenario.[40] Whereas worst-case climate scenarios predicted by the Intergovernmental Panel on Climate Change (IPCC) and the Panel on Energy Research and Development (PERD) estimated warming of 3.5°C to 4.5°C respectively, CanZinco's modelling assumed a change of 5.5°C in order to mitigate against thaw.[41] Based on the test cover results and geothermal models, CanZinco asserted in its 2002 "Mine Closure and Reclamation Plan" that a 1.25-metre cover depth was sufficient, comprising 1.0 metres of shale and 0.25 metres of armour surfacing.

Throughout the closure and reclamation process, however, much debate surrounded the depth—and thus cost—of the engineered tailings cover proposed by CanZinco. Some Arctic Bay residents asserted that the cover should have been 10 metres deep at the dock area and 5 metres deep at the industrial site, areas (correctly) perceived as the most contaminated.[42] Though the rationale behind these estimates is unclear from the archival record, public hearing transcripts reveal that the Hamlet of Arctic Bay regarded the tailings depth as an important issue and the community asserted its disappointment with the lack of information they had received regarding the tailings. In one hearing, the mayor of Arctic Bay, Joanasie Akumalik, explained:

> In the past we know that there was monitoring happening of the water and the tailings pond and even the air. We have also been aware of tailings monitoring devices that have not worked for long periods of time. We have not received the results from these activities. It is important that the local people in Arctic Bay become fully involved in this long term monitoring work and be trained to undertake this activity. It is important that the local people trust the results of these activities.[43]

This quote suggests some residents felt excluded from these scientific activities during Nanisivik's closure, in similar ways to how the community had felt marginalized during the mine's operation. To rectify this, some residents hoped that the community could observe the reclamation work undertaken at Nanisivik. An elder commented that:

> There should be someone observing when you are burying the tailing so that they can share their story and the information that they observe. Back in 1959 I was working for the Bay store. We used to hide things from the Manager before they came to the store so that the Manager would know it was a good store. I want someone there to observe the burying of tailings. If you tell me straight [it] will not contaminate the people and environment, I will believe I won't mind if you cover it. It is a concern without someone telling me that it won't have impact on my life. I want someone to observe. There will be work for Arctic Bay residents

> to work on the clean-up but when you are covering the tailings I want someone too. I want to see the picture of the tailings on the side of it. I'm serious here. People are serious here. We should ask all kinds of questions here.[44]

Rigorous monitoring was important for many residents to trust that the impacts of mining on their health and livelihoods had been offset. As well, these recommendations positioned community members as independent observers who could fill employment positions during reclamation and confirm whether work was being conducted correctly.[45]

While the cover depth issue was important for the health and well-being of the residents of Arctic Bay, it was equally important for CanZinco in determining the total amount of the security bond—a figure disputed by CanZinco and the Nunavut Water Board. On behalf of INAC, Brodie Consulting initially estimated that a cover depth of 1.75 metres was required, based on the fact that one of the test cells had experienced thawing to a depth of 1.59 metres.[46] Brodie later suggested that a 1.5-metre cover depth was required, still costing $1.25 million more than CanZinco's estimate of 1.25 metres. These cover depth estimations were of utmost importance to CanZinco, as they represented significant sums of money needed to pay for the surface covering—at the very least, $1.25 million was at stake.

CanZinco asserted the legitimacy of its estimate by presenting its cover depth as a "scientifically sound" estimate. CanZinco stressed that a depth of 1.25 metres was sufficient to keep the tailings frozen by highlighting that the data input into the geothermal model was more conservative than the estimates used by world-renowned scientific panels such as the IPCC. Emphasizing the authority of its scientific facts, CanZinco declared:

> We have calculated with the warming effect, so that's calculated in there. Global warming, as you mentioned, is a concern, and so we had, as I mentioned, included modelling that takes the worst-case scenario that Environment Canada offers you now over the years, we include that in the mine. And like any engineering we do, that's the best you can do, it has to be based on some scientific data, and that is based on *sound scientific data*.[47]

As this quote suggests, the scientific method not only produced knowledge about the environment, but this method in itself was presented as an authoritative and reliable source for the production of knowledge.

Indeed, CanZinco heavily relied on arguments based in notions of scientific expertise to validate its estimate and protest the valuations made by Brodie Consulting and the community. Throughout the closure and reclamation period at Nanisivik, CanZinco had urged the intervening parties to use "good science to come up with the best answers."[48] In public hearings, CanZinco introduced scientific and technical consultants as "independent and outside professionals,"[49] neutral parties external to the politics of reclamation and without bias. This is not to say that one estimate was more accurate than another, but rather CanZinco sought to present its rationale as "scientifically sound" in order to legitimize its estimate of the cost of the cover depth. For instance, CanZinco wrote in one letter to the NWB that:

> The intervening parties who are saying 1.25m is insufficient are not supporting this with any concrete information. They are *simply* and quite *arbitrarily* saying that they *intuitively* assume that 1.25 metres is not enough, and more cover should be added. If the intervening parties are able to take their *rationale* for additional coverage, at the very least a *meaningful technical* debate could ensue, and CanZinco is confident that it would prevail. CanZinco is currently at a disadvantage, though, where it presents scientifically defensible information and the only rebuttal is "we want more."[50]

In this quote, non-scientific estimates are cast as "arbitrary" and "intuitive," whereas scientific expertise is "meaningful" and "rational." Again, this is not to argue that the science behind each estimate was correct (or incorrect), but rather that this discourse inscribed science with the power to adjudicate and validate competing claims over reclamation, in such a way that at times it delegitimized the non-scientific estimates suggested by the community. Indeed, some residents were disappointed that suggestions they made in public hearings were not acted upon.[51] In this way, CanZinco-sponsored research not only produced an economic valuation (of the cost of reclamation), but necessarily reproduced the authority of

science: an explicit example of the way that the closed Nanisivik mine was a site for the production of contested valuations (of the cost of reclamation) and the scientific knowledge that legitimized these valuations.

CONCLUSION

After many meetings and much technical debate between the intervening parties, it was agreed that a 1.25-metre cover depth would be appropriate. The security bond was finally set at $17.6 million, and CanZinco's closure and reclamation plan was approved in 2004. It had become increasingly clear that the Nanisivik townsite and infrastructure would have to be demolished, as efforts to find alternate uses for the site were unsuccessful and contamination proved a costly problem. Many buildings had exceeded their lifespan, and those still in usable condition required as much as $50 million over four years for renovation.[52] After reclamation was completed in 2008, the security bond was reduced to $2 million to cover a five-year post-closure monitoring period. CanZinco estimated in a 2009 public hearing that the company had spent $17 million and that Wolfden had spent $12 million on reclamation at the site.[53]

Now, Nanisivik's mining infrastructure, housing, and support facilities are all but gone from the site. This was not an inevitable outcome of Nanisivik's life cycle, however. Some of Nanisivik's mining infrastructure continued to embody value: it was dismantled and reconfigured at other mine sites in Northern Canada. Furthermore, CanZinco mobilized a counter-discourse to the mining imaginary—the finality of mine closure—by casting the Nanisivik minescape as a valuable (and uncontaminated) space. In fact, after the closure of the mine, Nanisivik became a landscape of data production and economic valuation: scientific and technical consultants were hired from several external engineering firms, and technological infrastructures were erected in order to mine data from the environment. The closed Nanisivik minescape had become a hive of new activity that produced scientific knowledge and informed valuations of the cost of reclamation, which were disputed by CanZinco (as payee of the reclamation) and the Government of Nunavut (as regulator of the reclamation). The most fascinating aspect about this scientific

production process is that this knowledge making embodied scientific authority and neutrality that was used to assert the cost of reclamation by these different parties. These efforts not only generated scientific knowledge about the environment at Nanisivik, but the intervening parties cast this knowledge as being neutral, external, and unbiased—the most reliable knowledge for determining the cost of reclamation. Efforts to legitimize scientific knowledge concurrently legitimized valuations of the cost of reclamation. Thus, despite appearing to be an economically worthless post-productive space—as popularly imagined of closed mines under the mining imaginary—Nanisivik was a site of the production of both scientific knowledge and valuations of the cost of reclamation.

As such, this chapter favours a reading of Nanisivik's closure as an important historical-geographical event in the life of the mine, set amidst Nunavut's transforming political and regulatory context, and thereby negotiated and navigated by various actors (such as community members, government officials, and mine company representatives) with different, and at times, conflicting interests in the mine's closure and reclamation. Far from an unproductive, valueless, or lifeless space, the townsite continued to be valued in different (and contested) ways after the mine's closure and during reclamation. The case of Nanisivik prompts a reconsideration of the political-economic function and character of "post-productive" landscapes to account for the ongoing, and often contested, historical-geographical reconfiguration of such landscapes after resource extractive activities have formally ended.

NOTES

1 "Nanisivik to Die Four Years Early," *Nunatsiaq Online*, 2002, accessed April 2011, http://www.nunatsiaqonline.ca/archives/nunavut011102/news/nunavut/11102_1.html.

2 Mr. Oqituq, "Nanisivik Mine Type A Water License Renewal and Amendment Application," Nunavut Water Board Official Public Hearing Transcripts, February 2009, 184, accessed April 2011, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY/ 1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1AR-NAN0914/2%20ADMIN/ 4%20HEARINGS/2%20HEARING/2008%20Hearing/.

3 David Robertson, *Hard as the Rock Itself: Place and Identity in the American Mining Town* (Boulder: University of Colorado Press, 2006). See also Gavin Bridge, "Contested Terrain: Mining and the Environment," *Annual Review of Environment and Resources* 29 (2004): 205–59.

4 Ben Marsh, "Continuity and Decline in the Anthracite Towns of Pennsylvania," *Annals of the Association of American Geographers* 77, no. 3 (1987): 337–52; William Wyckoff, "Postindustrial Butte," *Geographical Review* 85, no. 4 (1995): 478–96; Robertson, *Hard as the Rock Itself.*

5 Trevor Barnes, "Borderline Communities: Canadian Single Industry Towns, Staples, and Harold Innis," in *B/ordering Space*, eds. Henk van Houtum, Olivier Kramsch, and Wolfgang Zierhofer (Burlington, VT: Ashgate Publishing, 2005); Trevor Barnes, Roger Hayter, and Elizabeth Hay, "Stormy Weather: Cyclones, Harold Innis, and Port Alberni, BC," *Environment and Planning A* 33 (2001): 2127–47; John Bradbury, "Towards an Alternative Theory of Resource-Based Town Development in Canada," *Economic Geography* 55, no. 2 (1979): 147–66; John Bradbury, "Declining Single-Industry Communities in Québec-Labrador, 1979–1983," *Journal of Canadian Studies* 19, no. 3 (1984): 125–39; Gavin Bridge, "Resource Triumphalism: Postindustrial Narratives of Primary Commodity Production," *Environment and Planning A* 33 (2001): 2149–73; Gavin Bridge, "Material Worlds: Natural Resources, Resource Geography, and the Material Economy," *Geography Compass* 3, no. 3 (2009): 1217–44; David S. Trigger, "Mining, Landscape, and the Culture of Development Ideology in Australia," *Cultural Geographies* 4, no. 2 (1997): 161–80.

6 Bob Carreau, Nunavut Water Board Official Public Hearing Transcripts, 2009, 18.

7 Hickling-Partners Inc., "Evaluation of the Nanisivik Project" (Canada Department of Indian Affairs and Northern Development, 1981), 6.

8 "Strathcona Agreement," in Robert Gibson, "The Strathcona Sound Mining Project: A Case Study in Decision Making" (Science Council of Canada, No. 42, 1978).

9 Department of Indian and Northern Affairs, "North of 60: Mines and Mineral Activities 1976" (Mining Division, Northern Non-Renewable Resources Branch, 1976).

10 For example, BC Research, "Lethal and Sublethal Bioassays on Tailing from Nanisivik Mine Ore" (Prepared for Strathcona Mineral Services, Project 1552, Progress Report No. 3, 1975); C. T. Hatfield and G. L. Williams, "A Summary of Possible Environmental Effects of Disposing Mine Tailings into Strathcona Sound, Baffin Island" (Hatfield Consultants Limited Arctic Land Use Research Program, 1976); S. Reedyk, "Profiles of Baffin Communities Affected by Closure of the Nanisivik Mine and a Summary of the Impact of Closure on

the Communities" (Indian and Northern Affairs Canada, Mining Management and Infrastructure Division, 1987).

11 Department of Indian and Northern Affairs, "North of 60," 50.

12 Cabinet Committee on Government Operations, "Record of Committee Decision: Strathcona Sound Project," Mineral and Metal Commodities Branch Registry Files, RG21 Acc 1996–97/723 box 10 file 1.50.15.3 vol. 5., p. 10, Library and Archives Canada; Gibson, "The Strathcona Sound Mining Project."

13 Bob Carreau, "Nunavut Water Board Final Closure and Reclamation of the Nanisivik Mine," Nunavut Water Board Official Public Hearing Transcripts, June 2004, 13–16, accessed April 2011, ftp://nunavutwaterboard.org1%20PRUC%20PUBLIC%20REGISTRY /1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1ARNAN0914/2%20ADMIN/ 4%20HEARINGS/2%20HEARING/2004/.

14 Brubacher & Associates, "The Nanisivik Legacy in Arctic Bay: A Socio-economic Impact Study," prepared for the Department of Sustainable Development, Government of Nunavut, 2002.

15 Hickling-Partners Inc., "Evaluation of the Nanisivik Project," 36.

16 Kunuk Oyukuluk, Nunavut Water Board Official Public Hearing Transcripts, 2004, 121.

17 Moses Akumalik, "Public Hearing Minutes," Nunavut Water Board Official Public Hearing Transcripts, July 2002, 44, accessed April 2011, ftp://nunavutwaterboard.org1%20PRUC%20PUBLIC%20REGISTRY/1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1ARNAN0914/2%20ADMIN/4%20HEARINGS /2%20HEARING/2002%20Renewal /PH%20July%2022-24,%202002/.

18 Mucktar Akumalik, Nunavut Water Board Official Public Hearing Transcripts, 2004, 100.

19 Indian and Northern Affairs Canada, "Mine Site Reclamation Policy for Nunavut," Minister of Indian Affairs and Northern Development, Ottawa, ON, INAC, 2002, 2. The changing context of regulation between the Strathcona Agreement and the Nunavut Land Claims Agreement is also noted in Léa-Marie Bowes-Lyon, Jeremy P. Richards, and Tara M. McGee, "Socio-Economic Impacts of the Nanisivik and Polaris Mines, Nunavut, Canada" in *Mining, Society, and a Sustainable World*, ed. J.P. Richards (Heidelberg: Springer-Verlag, 2009).

20 Indian and Northern Affairs Canada, "Mine Site Reclamation Policy for Nunavut."

21 "Nanisivik Owner Wants More Time to Post $17.6 Million Bond," *Nunatsiaq Online*, 2002, accessed April 2011, http://www.nunatsiaqnews.com/archives/nunavut021101/news/nunavut/21101_04.html; "CanZinco heading for showdown with NWB?," *Nunatsiaq Online*, 2002, accessed April 2011, http://

www.nunatsiaqonline.ca/archives/nunavut021108/news/nunavut/21108_01.html; "Arctic Bay Residents Want Details on Nanisivik Health Risks," *Nunatsiaq Online*, 2003, accessed April 2011, http://www.nunatsiaqonline.ca/archives/30905/news/nunavut/30905_05.html.

22 Breakwater Resources, "Letter from Breakwater to NWB regarding security bond arrangements," 2002, accessed April 2011, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY/1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1AR-NAN0914/2%20ADMIN/4%20HEARINGS/2%20HEARING /2002%20Renewal/Post%20Hearing%20Submissions/BWR/English/.

23 Bill Heath, "Exhibit 1: opening remarks by Bill Heath, vice-president of CanZinco," Public Meeting at Arctic Bay, 2002, accessed April 2011, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY /1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1AR-NAN0914/2%20ADMIN/ 4%20HEARINGS/2%20HEARING /2002%20Renewal/Exhibits%20Undertakings/.

24 Ibid.

25 Ibid.

26 B. Young, "Memo: Wolfden Resources: massive sulphide discovery at High Lake," 2003, accessed April 2011, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY/1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1AR-NAN0914/3%20TECH/10%20A%20and%20R%20(J)/2003/.

27 CanZinco, "Final Closure and Reclamation Report," 2004, accessed January 2012, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY/1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1ARNAN0914/3%20TECH/ 10%20A%20and%20R%20(G)(J)/2004/G3%20Final%20Closure%20Plan/2004%20Final%20AR%20plan/G.4%20Cover%20Report/G.4%20Report/.

28 EBA Engineering Consultants Ltd., "Soil sampling program report," 2002, accessed April 2011, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY/1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1AR-NAN0914/2%20ADMIN/4%20HEARINGS/ 2%20HEARING/2002%20Renewal/Post%20Hearing%20Submissions/GN/English/.

29 Dillon, "Dillon Consulting Final Assessment," 2003, accessed April 2011, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY/1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1AR-NAN0914/2%20ADMIN/0%20GENERAL/2003/.

30 EBA, "Soil sampling program report."

31 Nanisivik Mine, "Letter from Nanisivik mine to Thomas Kudloo of NWB regarding final submissions," 2002, 5, accessed April 2011, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY/1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1AR-NAN0914/2%20ADMIN/4%20

HEARINGS/ 2%20HEARING/2002%20Renewal/Post%20Hearing%20Submissions/BWR/English/.

32 Bob Carreau, Nunavut Water Board Official Public Hearing Transcripts, 2009.

33 Leah Oqallak, Nunavut Water Board Official Public Hearing Transcripts, 2004; Nunavut Water Board Official Public Hearing Transcripts, 2002.

34 M. Kalin, "Ecological Engineering for Gold and Base Metal Mining Operations in the Northwest Territories," *Environmental Studies*, no. 59 (Ottawa, 1987); Bo Elberling, "Environmental Controls of the Seasonal Variation in Oxygen Uptake in Sulfidic Tailings Deposited in a Permafrost-Affected Area," *Water Resources Research* 37, no. 1 (2001): 99–107; Bo Elberling, "Temperature and Oxygen Control on Pyrite Oxidation in Frozen Mine Tailings," *Cold Regions Science and Technology* 41 (2005): 121–33; Curt Kyhn and Bo Elberling, "Frozen Cover Actions Limiting AMD from Mine Waste Deposited on Land in Arctic Canada," *Cold Regions Science and Technology* 32 (2001): 133–42.

35 BCG Engineering, "Engineering Design of Surface Reclamation Covers," 2003, accessed January 2012, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY /1%20INDUSTRIAL/1A/1AR%20%20Remediation/1ARNAN0914/3%20TECH/10%20A%20and%20R%20(G)(J)/2004/G3%20Final%20Closure%20Plan/2004%20Final%20AR%20plan/G.4%20Cover%20Report/G.4%20Report/G.4%20Cover%20Report%20Final.pdf.

36 CanZinco, "Final Closure and Reclamation Report."

37 CanZinco, "Final Closure and Reclamation Report"; BCG Engineering, "Engineering Design of Surface Reclamation Covers."

38 CanZinco, "Final Closure and Reclamation Report," ix.

39 CanZinco, "Final Closure and Reclamation Report"; BCG Engineering, "Engineering Design of Surface Reclamation Covers."

40 BCG Engineering, "Engineering Design of Surface Reclamation Covers."

41 Nunavut Water Board, Nunavut Water Board Official Public Hearing Transcripts, 2002.

42 Nunavut Water Board, "Public hearing meeting notes," 2004, accessed April 2011, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY /1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1AR-NAN0914/2%20ADMIN /4%20HEARINGS/0%20GENERAL/2004/.

43 Hamlet of Arctic Bay Working Group, "Submission to the Nunavut Water Board," 2002, 2, accessed April 2011, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY /1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1AR-NAN0914/2%20ADMIN/4%20HEARINGS/2%20HEARING/2002%20Renewal/Exhibits%20

Undertakings/020726NWB1NAN9702%20Exhibit11-Submission%20of%20Hamlet%20AB%20Wrkg%20Group English.pdf.

44 Leah Oqallak, Nunavut Water Board Official Public Hearing Transcripts, 2002, 43.

45 Nunavut Water Board, "Public hearing meeting notes."

46 Brodie Consulting, "Nanisivik Mine: Reclamation Cost Estimate," prepared for Indian Affairs and Northern Development, Water Resources Division, June 2002, accessed April 2011, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY /1%20INDUSTRIAL/1A/1AR%20-%20Remediation/1ARNAN0914/2%20ADMIN/ 3%20SUBMISSIONS/2002%20Renewal/DIAND/.

47 Bob Carreau, Nunavut Water Board Official Public Hearing Transcripts, 2004, 118. Emphasis added.

48 Bob Carreau, "Letter from Nanisivik mine to Thomas Kudloo of NWB regarding final submissions," 2002, 26, accessed April 2011, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY/1%20INDUSTRIAL /1A/1AR%20-%20Remediation/1AR-NAN0914/2%20ADMIN/4%20HEARINGS/ 2%20HEARING/2002%20Renewal/Post%20Hearing%20Submissions/BWR/English/.

49 Heath, "Exhibit 1," 3.

50 Nanisivik Mine, "Letter from Nanisivik mine to Thomas Kudloo of NWB regarding public hearing outcomes," 2002, 3, accessed April 2011, ftp://nunavutwaterboard.org/1%20PRUC%20PUBLIC%20REGISTRY/1%20INDUSTRIAL /1A/1AR%20-%20Remediation/1AR-NAN0914/2%20ADMIN/4%20HEARINGS/ 2%20HEARING/2002%20Renewal/Post%20Hearing%20Submissions/BWR/English/. Emphasis added.

51 Léa-Marie Bowes-Lyon, "Comparison of the Socio-economic Impacts of the Nanisivik and Polaris Mines: Sustainable Development Case Study" (MSc thesis, University of Alberta, 2006).

52 Nunavut Water Board, Nunavut Water Board Official Public Hearing Transcripts, 2004.

53 Nunavut Water Board, Nunavut Water Board Official Public Hearing Transcripts, 2009.