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Aboriginal communities, traditional knowledge, and the environmental legacies of extractive development in Canada

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ABSTRACT

Community and regulatory concern over the ongoing impacts of historic extractive developments has spurred efforts to clean up abandoned and contaminated sites across the Circumpolar North. Yet, as the environmental legacies of northern development proliferate, questions remain about how successfully local or Indigenous traditional knowledge (TK) has been included in and applied to issues of remediation, reclamation and restoration at former industrial sites. In northern Canada, Indigenous TK has in the last 40 years been formally incorporated into wildlife management and in some cases approval processes for industrial projects, but has less frequently been applied to remediation issues. This paper will focus on the high profile case of the Canadian government's attempt to remediate arsenic contamination at the former Giant Mine in the Northwest Territories. This abandoned mine contains 237,000 t of arsenic trioxide stored underground adjacent to the city of Yellowknife and the Dene communities of Dettah and Ndilo. While the Giant Mine Remediation Project professed a desire to incorporate TK into the reclamation project, the complex technical nature of the process, and a fundamental misunderstanding of the epistemological basis of Indigenous TK, has prevented anything more than token inclusion of such knowledge. Using transcripts from the recent environmental assessment of the project, we argue that proponents of the remediation project failed to acknowledge that Indigenous TK is not simply a storehouse of scientific data on plants and animals, but is woven together with historical memories of rapid social, economic and environmental changes associated with northern development projects

1. Introduction

In spite of at-times hyperbolic contemporary rhetoric around Arctic resources and the "new North" (Smith, 2010; Emmerson, 2010; Anderson, 2009), the globe's northern latitudes have been subject to industrial resource-extractive activities for at least a century (Stuhl, 2013). Particularly after the Second World War, Arctic rim countries promoted intensive industrial development in their remote northern territories, often based around extractive resources such as minerals and hydrocarbons. As Mark Nuttall has noted, "regions and people throughout the circumpolar world have a rich history of experiencing the economic, environmental and social impacts of extractive industries" (Nuttall, 2010, 33). Increasingly, scholars (and others) are drawing on these historical experiences to inform contemporary development impacts and decision-making, particularly surrounding environmental protection and the (beneficial) participation of Northern indigenous peoples in extractive developments (Gibson and Klinck, 2005; Stammler and Wilson, 2006; Angell and Parkins, 2011; Rodon et al., 2013). A considerable body of research has now accumulated on the construction, operational, and even closure phases of extractive developments in Arctic and Northern regions, much of it highlighting the links between resource exploitation, environmental degradation, and the social and economic dislocation of local communities (e.g., Coates, 1991; Josephson, 2014; Morse, 2003; Hacquebord, 2009; Piper, 2009; Sandlos and Keeling, 2012a; Tester et al., 2013).

Amidst this growing attention to the politics of extractive development in the circumpolar North, the long-term environmental legacies of such developments are less well-explored. The cyclical and volatile nature of remote resource economies means that extractive sites may be subject to sudden closure and abandonment, often leaving behind environmental problems (Aschmann, 1970; Keeling, 2010). But whether a particular development is ongoing, completed, or ephemeral, the legacies of historic resource-extractive activities may remain evident in the landscape and environment for long afterwards. This is partly because of the slow recovery rates of many high-latitude

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ecosystems, but also because of the material persistence of the environmental changes themselves. In addition to surface disturbances from extractive activities and infrastructure, mining and hydrocarbon production produce significant polluting wastes, including tailings and wastewaters. Radiological and chemical contaminants also affect the local environment near mineral processing and oil and gas installations, including air pollution, fuel spills, and community wastes (Walker et al., 1987; Poland et al., 2003). These contaminants may move and/or accumulate in the biota, and persist for decades or more after the putative 'end' of extractive activities (Sandlos and Keeling, 2013).

Community and regulatory concern over the ongoing impacts of historic extractive developments has (in some cases) spurred efforts to clean up abandoned and contaminated sites across the Circumpolar North. Although there is a thriving technical literature on environmental remediation in the Arctic (Jorgenson et al., 2003; Olsen, 2001; Udd and Bekkers, 2003; Udd and Keen, 1999), the scope of the remediation challenges in the region is not well understood. At the local level, the incorporation of community knowledge and citizen participation in remediation policy and practice, particularly involving Indigenous people, represents a poorly understood aspect of extractive development. (Assembly of First Nations, 2001; McBeath and Shepro, 2007; NOAMI, 2003; Sistili et al., 2006). Because contamination and environmental remediation tend to be framed as technical or scientific issues, the contributions of local and Indigenous people are often limited. Indigenous knowledge and experience, in particular, is typically confined to matters of "traditional" knowledge, such as pre-contact

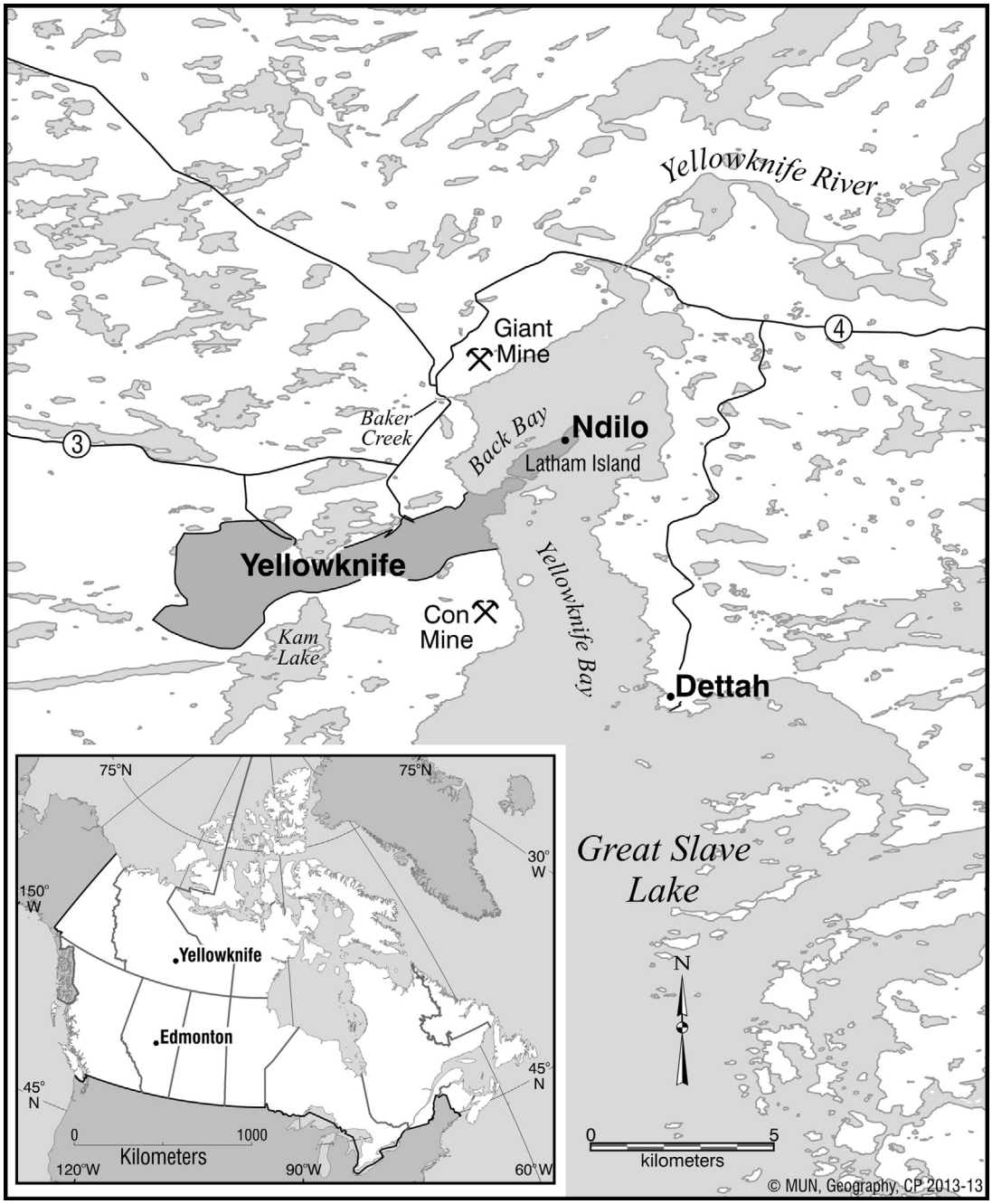

Fig. 1. Location of Giant Mine and City of Yellowknife. The Yellowknives Dene communities of Ndilo and Dettah were affected by air and water pollution from the mine before its closure in 2004. Map by Charlie Conway.

cultural history and knowledge of biotic and land-based resources. Although there exist a few studies that consider the role of Indigenous knowledge in remediating contaminated landscapes in the Arctic (cf. Cassady, 2007; Sistili et al., 2006), environmental remediation is typically understood as an engineering and technical problem (NOAMI, 2003). Indigenous knowledge and perspectives may also tend to be marginalized because remediation activities are regarded as improvements or rehabilitation of the local environment, and thus above criticism or controversy. Yet there are environmental risks associated with remediation; activities ranging from building demolition to surface cleanup may mobilize and spread toxic material through air and water (Lerner, 2010). Traditional knowledge may be sought as a means to measure potential impacts from remediation activities, or establish baseline ecological conditions prior to and/or during a development project in order to inform restoration goals, but again this serves to confine it to issues of flora and fauna.

This marginalization of Indigenous knowledge reflects larger problems integrating Indigenous knowledge systems with western science across a broad range of renewable and non-renewable resource management regimes. Within the field of wildlife management, for instance, some critics have suggested that efforts to integrate traditional knowledge and western science often subsume the former as a form of supplementary ecological data, neglecting the ethical and political claims embedded within Indigenous knowledge. The end result is often an uneven struggle for legitimacy between knowledge systems constructed by actors who are ultimately motivated beliefs, values, and goals characterized by "inherent incompatibilities" (White, 2006; Christensen and Grant, 2007; Cruikshank 1998; Ellis, 2005; Nadasdy, 2003a,b, 2005; Spak, 2005; Tester and Irniq 2008). This critique has been extended to the issue of the confinement of Indigenous perspectives on industrial development to the local and the traditional spheres. Anthropologist Andrea Procter (2012a,b) has argued that the tendency to equate Indigenous knowledge with tradition, local geographies, and wildlife has constituted a conscious strategy of excluding Aboriginal perspectives from the "big money" resource sector in Labrador, primarily minerals and energy. Similarly, Emilie Cameron explains that the literature on human dimensions of climate change has failed to engage with, and be influenced by, "critical writings on the discursive production of Indigenous peoples as traditional and local," with the consequence that resource extraction and shipping do not usually figure in vulnerability assessments (Cameron, 2012, 104–105). Some resource companies have highlighted Indigenous use of mineral resources (copper at Kugluktuk, Nunavut, for example) as a rhetorical strategy designed to demonstrate continuity between modern resource exploitation and traditional resource use (Cameron, 2011). However, large-scale, for-profit, capital-intensive activities are typically understood to be inherently transnational and modern in nature, and as such almost exclusively the purview of the non- Indigenous world, falling outside the realm of competency typically attributed to Indigenous people (cf. Blaser, 2004). Such a constricted view of Indigenous knowledge thus "makes it easy for scientists and resource managers to disregard the possibility that Aboriginal peoples might possess distinct cultural perspectives on modern industrial activities such as logging and mining" (Nadasdy, 2003a, p. 120–121).

The remediation phase of development projects raises distinct issues with Indigenous knowledge, historical experience and memory precisely because it addresses environmental legacies of past extractive activities rather than potential economic and ecological impacts of development in the future. Our research on northern Canada has suggested that the introduction of a major development project can represent a central, if not the central historical moment in their encounter with southern Canadian expansionism and colonialism, ushering in a series of rapid and at times destabilizing economic, environmental, and cultural changes. Contemporary efforts to address abandoned mines or toxic sites may revive the historical conflicts and sense of injustice associated with the original development and its environmental impacts (Keeling and Sandlos, 2009; Sandlos and Keeling, 2013). These conflicts may be reproduced in material ways, as remediation activities raise immediate and long terms risks associated with the mobilization and/or containment of toxic materials at abandoned mine sites. They may also be reproduced at a more conceptual level, as Indigenous communities use the remediation process (public hearings, consultations, environmental assessments) as a means to seek redress for historical inequities, particularly the unjust distribution of harms and benefits, that accompanies the original mine development.

To illustrate the tensions between Indigenous perspectives and techno-scientific approaches to remediation, we examine the politics of knowledge surrounding Canada's most complex and expensive mine remediation project, the Giant Mine in Canada's Northwest Territories (Fig. 1). There, a half-century of gold mining and processing left a toxic legacy of 237,000 t of arsenic trioxide buried at the site, along with widespread surface contamination and a variety of abandoned mine works. Because the responsible company (Royal Oak Mines) went into receivership in 1999, these severe environmental problems became the responsibility of Canada's federal government, which proposed a controversial solution: to freeze the arsenic stored in underground chambers and maintain the site in perpetuity (AANDC, 2013). The recently concluded environmental assessment process evaluating this proposal revealed considerable public concern in the city of Yellowknife (which includes the mine) and the adjacent Dene communities of Dettah and Ndilo over both the technical and administrative arrangements surrounding the "frozen block" plan. Our examination of public hearings and other forums devoted to the issue also highlights the shortcomings of efforts by regulators and project proponents to effectively incorporate traditional knowledge and the experience of local Indigenous people into the review process. Throughout the nearly six-year review and assessment process, the Yellowknives Dene often struggled to have their historical experience of environmental injustices and cumulative impacts of development acknowledged as a relevant input into the planning process. The narrow scope for the review and the weak inclusion of TK in the remediation planning phase reflected the project's orientation toward technical solutions and western scientific modes of knowledge. Nor were the Yellowknives' traditional knowledge of arsenic, its impacts on their health, and the possible additive impact of new arsenic loading in air and water from the remediation project effectively acknowledged. What regulators understood to be TK applicable to a remediation project (as mentioned above, supplementary ecological data about pre-development conditions) is for local communities a knowledge base that encompasses a broad array of social and ecological changes related to the history of the original mining operation. As a result, we suggest the environmental review process reproduced the problems of the confinement of TK noted in the literature, and illustrated the difficulty proponents and regulators have in conceptualizing how TK may be applied to an industrial remediation project.

2. Navigating the environmental assessment

The regulatory and technical issues surrounding the clean-up of Giant Mine were acknowledged by all participants in the remediation plan and subsequent environmental assessment (EA) to be uniquely complex and challenging. Remediation planning to address the underground arsenic trioxide and surface

contamination began even before the bankruptcy of the mine's owner, and continued even as mining resumed under another company between 2000 and 2004 (Deton'Cho Environmental Alliance, 1999; AANDC, 2013). In the wake of the previous owner's bankruptcy, the Canadian Federal Government (Department of Indian and Northern Affairs)[1] assumed responsibility for most of the site's environmental liabilities, and along with the Government of the Northwest Territories, developed an arsenic management plan that proposed freezing in situ the 237,000 t of toxic arsenic trioxide stored in 14 underground chambers and stopes (SRK Consulting and SENES Consultants, 2007). The remediation plan also called for surface remediation, the removal of contaminated mine buildings (including the gold roaster complex), and the restoration of Baker Creek, a small, polluted waterway running through the mine site (see Fig. 1). These plans were developed and reviewed by consultants and technical experts, but in spite of some efforts at public consultation, by 2008 public concern in Yellowknife around the plan came to a head. In an unprecedented show of unity, the City of Yellowknife, with the support of the local member of the territorial legislature and the Yellowknives Dene First Nation (YKDFN)[2], made a mandatory referral to the territorial environmental regulatory body, the Mackenzie Valley Land and Water Board, triggering a comprehensive environmental assessment (O'Reilly, 2013; McDiarmid, 2008).

The context of environmental assessment in the Northwest Territories and the main regulatory body, the Mackenzie Valley Environmental Impact Review Board, are important to note. Land and environment in Canada's Northwest Territories were, until very recently, jointly administrated by the federal and territorial governments. In 1998, a Land and Water Board was established through the *Mackenzie Valley Resource Management Act* (MVRMA) as a co-management board and administrative tribunal to review development proposals for environmental assessment and/or environmental impact review (White et al., 2007). Since large portions of the Northwest Territories are subject to historic treaties with First Nations, as well as concluded or ongoing Aboriginal land claims, the Review Board consists not only of federal and territorial appointees, but also half its members are appointed by Aboriginal land-claim organizations. At the time of the Giant Mine EA, the Board included five Aboriginal members, including Chairperson Richard Edjericon, himself a former Chief of the Yellowknives Dene First Nation.

In addition, the MVRMA requires community consultation and the specific consideration of impacts on Aboriginal lands and communities. This requirement includes the incorporation of traditional knowledge into the assessment and evaluation process. For the purposes of its reviews, the board defines TK as: knowledge about the environment; knowledge about use and management of the environment; and values about the environment. Significantly, "the MVRMA recognizes that the Indigenous people of the Mackenzie Valley possess invaluable TK by explicitly putting it on the same footing as scientific knowledge for Board decision making" (White et al., 2007, 11–12). In its first decade of operation, the Board gained considerable experience in incorporating traditional knowledge and indigenous testimony into what could often be highly technical and legalistic assessment processes. Nevertheless, some critics suggest the legal mandates and quasi-judicial operations of this and other co-management boards tend to favor Western knowledge and decision-making practices, resulting in a shallow incorporation of traditional knowledge (Ellis, 2005; Spak, 2005; White, 2006).

2.1. TK and development assessment at giant

From the outset of the Giant Mine review, the unusual circumstances were apparent of using an environmental assessment process that was designed to evaluate resource development *proposals* to examine a mine *remediation* plan. In scoping and drafting terms of reference for the EA, the Review Board grappled with the contradictions of assessing the "impacts" of a proposal to redress the environmental legacies of a past development. For their part, the project proponents, the federal and territorial governments, argued for a narrow geographical and temporal scope for the assessment, since the proposed activities focused on stabilizing and remediating the environmental hazards on and around the polluted mine site itself, which should be considered the baseline environmental conditions. In particular, the proponents sought to limit assessment of the historical legacies of the mine on local communities and the surrounding environment, since they derived not from the remediation activities, but from past unregulated developments (INAC, 2008).

By contrast, community groups and the Yellowknives Dene First Nation argued vigorously for the review to consider the "full geographic extent of impacts on the environment by the mine over its lifetime," including impacts on local community health and land use (Yellowknives Dene First Nation, 2008). The mine affected lands and waters (including Yellowknife Bay on Great Slave Lake) traditionally used by Dene people for hunting, gathering, fishing and travel. For YKDFN, remediation would include the restoration of the land to accommodate traditional use and the recognition of past injustices suffered by the community (including displacement, arsenic contamination, and poisoning of the local environment). Local environmental activist Kevin O'Reilly called for the review to include "the cumulative effects of all mining operations in Yellowknife," including Giant and several other mines, "and the effects they had on the people of the Yellowknife area and its environment, including the aerial and aquatic dispersion and deposition of contaminants into soil and water" (O'Reilly, 2008). Both YKDFN and O'Reilly (as well as another Aboriginal organization, the North Slave Métis Alliance) emphasized the critical role of Aboriginal knowledge in establishing remediation goals and in reckoning with the environmental and social legacies of the mine.

In spite of these appeals, the Review Board adopted a narrow geographic and temporal scope for the environmental assessment. While the Board's scoping decision noted "the legacy impacts of mining . . . are unfortunate and regrettable," they were deemed not relevant to the proposed remediation, except as the cause of the current baseline environmental conditions, since they were not caused by the project proponents (MVEIRB, 2008). Further, since the remediation plan focused on securing the mine site, tailings and arsenic deposited underground, the historic dispersion of arsenic in the wider environment beyond the mine site (still detectible in surface runoff and lake sediments in the surrounding area) was not eligible for consideration.

In preparing its technical reports for the EA, the Giant Mine Remediation Team (GMRT) made every effort to demonstrate that TK has or would be incorporated into the remediation process. In the *Developer's Assessment Report (DAR)*, the GMRT highlighted that they had funded a Yellowknives TK study and various community events where they had solicited feedback on aspects of the project,

[1] This body would later be renamed Indian and Northern Affairs Canada (INAC), then Aboriginal Affairs and Northern Development Canada (AANDC). As implied by the name, this federal department is jointly responsible (with territorial authorities) for administering land, resources, and Aboriginal policy in Northern Canada. The many roles it plays in the Giant Mine case—project proponent, land regulator, and primary authority responsible for fulfilling Canada's obligations to Aboriginal peoples—are a considerable source of controversy.

[2] Rather than "tribes" or "bands," Indigenous peoples in Canada that were formerly referred to as "Indians" are now typically identified as First Nations. More generically, descendants of the original inhabitants of Canada, whether First Nations, Inuit, or Métis (mixed heritage) people are referred to as Aboriginal people, though this terms is not without controversy.

including consideration of the remediation options for the arsenic chambers, surface remediation, and the risk assessment. In its report, the GMRT recognized that TK included a set of values about the land (as outlined in the MVEIRB definition of TK) grounded in traditional use values (fishing, hunting, gathering of berries, etc.). In addition, the report pointed to several areas in the remediation where TK would be incorporated, including the design elements for Baker Creek, access controls for the site, revegetating capped tailings deposits, and ongoing monitoring (INAC and GNWT, 2010, pp. 2-28-29).

Despite these commitments, the *DAR* was frustratingly opaque on exactly *how* all of this TK had been incorporated into the remediation process. Indeed, the *DAR* admitted the consultation sessions highlighted above were not successful platforms for the exchange and incorporation of TK: "elders in both Dene communities were strong and very articulate about the limited involvement of their people on issues related to the Giant Mine in general, and specifically about the lack of consideration of traditional knowledge. Some elders and Chiefs questioned the results of prior studies, including the Giant Mine Risk Assessment, because of the limited use of traditional knowledge" (INAC and GNWT, 2010, pp. 13-24-25). In response, the *DAR* proposed the creation of a joint Aboriginal and government panel "supporting the collection and consideration of traditional knowledge in future directions related to the remediation project" (INAC and GNWT, 2010, p. 24–25). Why this type of body had been excluded from the earlier stages of the remediation process is left unexplained. Such a seemingly last minute insertion reinforces the impression that TK is invoked in the DAR in a superficial manner, merely to satisfy the Mackenzie Valley Environmental Impact Review Board's (MVEIRB) mandate for inclusion.

At the root of this disconnect between TK and remediation planning is something even more fundamental: the narrow conceptual terms on which such knowledge may be incorporated into a process dominated by scientific and bureaucratic management regimes. As Nadasdy argues for wildlife management, TK is conceived by the proponents of the Giant Mine Remediation Project as a data gathering mechanism, with an emphasis on community monitoring of ecological phenomena such as berries, vegetation, wildlife and fish, rather than a broader worldview and set of values about appropriate relationships to land (Nadasdy, 2003a; INAC and GNWT, 2010, pp. 13-24-25). As such, TK is framed in a depoliticized way, one that excludes claims of environmental injustices and historical dispossession from local resources as part of the restorative process of healing the land. This basic conflict is not unique to Aboriginal communities: the discord between technical and community values in environmental remediation and restoration projects has long been a dominant theme in the literature (Burke and Mitchell, 2007; Higgs, 2003, 2006; Throop and Purdom, 2006). But as a recent collection of essays on restoration and environmental justice points out, indigenous groups around the globe often frame their concerns about remediation projects in terms of redressing the colonial aspects of development. Specific concerns include restoring historical land uses (including access to traditional sources of subsistence) and addressing the unjust distribution of environmental harms from development projects; in other words, recreating as much as possible the environmental conditions and resource regimes that existed prior to the incursion of development projects (Boyce et al., 2007).

2.2. TK and environmental justice claims

The Yellowknives Dene made very similar political claims to restorative environmental justice in the case of Giant Mine. One prominent demand is that the land should be restored to its pre-mining state. The remediation project thus should not merely contain and manage toxins but remove them, land should be remediated to a standard much higher than the proposed industrial designation, lost resources such as fish and berries should be restored to their former abundance, and the government should issue compensation and an apology for the history of pollution and dispossession associated with the mine. A YKDFN technical report submitted to the environmental assessment suggests that the First Nation is "fortunate that we still have elders who remember this area before there was a mine here, before the land was destroyed. The goal must always be to return that land to the same way it was" (YKDFN, 2012, p. 1). The aforementioned Yellowknives TK report adopted "the objective of restoring relationship[s]" as a key goal (YKDFN, 2005, p. 6). Rather than provide a catalog of data useful to project management, the report contains wide ranging testimony, taken primarily from pre-existing recordings or transcripts of elders, on Yellowknives Dene history, their relationship to the regional land base, and the impact of the mine. Isadore Sangris' thoughts on the impact of the mine are representative of many others:

> As a result of the mines in the area, the land has been wasted, destroyed and contaminated. Mining has occurred for more than 50 years and a lot of damage has occurred. The water is contaminated; rabbits and grouse are contaminated; the Dene people have become very cautious of eating tradition foods because of the heavy contaminants in the water, land and air. The contamination even destroys trees, marshes, habitat, and wild berries. All things that the Dene people want to use but cannot anymore. The land here cannot sustain them anymore. The Weledeh do not fish in the bay anymore; instead, they go to Wool Bay, they have to go to communities far from the mine to get their fish and water fowl (YKDFN, 2005, p. 20).

Others highlighted contact stories between Yellowknives Dene and prospectors, recounting how chiefs told the latter to leave the area, or in some cases how local people helped these newcomers. Even in the latter case, however, the injustices associated with the mine are exemplified by the story of Liza Crookedhand (as told by Rachel Crapeau and Isadore Sangris), who showed prospectors where to find gold at the Con site in exchange for a stove pipe. Sangris claimed that "the prospector tricked her, because he did not tell her that what she had was gold and [this] was worth money" (YKDFN, 2005, p. 13). Similar litanies about the lack of compensation (though there were some employment opportunities in the early days of the mines) and consultation at the inception of the gold mining period are matched by the abundance of stories about the ongoing impacts of the mines on land, health and livelihood in the region.

It is difficult to imagine how such stark testimony about the historical impact of the mine could be tangibly incorporated into a remediation process driven primarily by environmental engineering. The *Developer's Assessment Report* reiterated that the issue of compensation and an apology were outside the scope of the remediation project, though there was a promise to bring the issue to the attention of senior government officials (INAC and GNWT, 2010, 13–11). The remediation team also remained steadfast that the land could not be restored to a pre-mining state; ongoing contamination of water at the site and freezing in situ of the arsenic meant that Giant Mine would always be an actively managed and engineered site (INAC and GNWT, 2010).[3] Traditional

[3] These perpetual care requirements caused considerable concern among Aboriginal and non-Aboriginal residents of Yellowknife, particularly in terms of obligations to future generations and whether the site could feasibly be managed in a "forever" scenario. This issue is subject of an ongoing research collaboration between the authors, local community members and YKDFN.

knowledge perspectives on Giant Mine—based, as they were, on historical relationships to land and resources—were forced to fit in with the existing project parameters, not alter them or challenge their epistemological basis in any fundamental way.

In spite of this rejection of Dene claims, the environmental assessment public hearing in 2012 provided a forum for them to press the issue. The Yellowknives Dene, along with the North Slave Métis Alliance, used the hearing to raise issues that had been scoped out of the project, particularly the key priorities of historical mine impacts, the full restoration of the site, and compensation. Such appeals to tradition and a pre-mine harmony with nature relied to some degree on romantic view of the past. They may also contain some irony in light of the fact that the Yellowknives' development corporation—Det'on Cho Corporation—is the primary care and maintenance contractor for work at the Giant Mine site. This in itself became a source of discussion and controversy during the EA hearings in terms of whether these contracts might be seen as a source of compensation and community involvement (MVEIRB, 2012c, p. 211). Nonetheless, it is difficult to dismiss Dene and Métis claims as a mere nostalgic appeal to tradition. So sudden were the changes wrought by the introduction of gold mining at Yellowknife, so extreme were the impacts on the health, land and livelihoods of the Yellowknives Dene in particular, that historical memory and traditional knowledge provide an important and convincing means to establish baseline social and ecological conditions prior to the mining era. The elders' testimony was at root political, weaving together living historical memory of mining impacts, traditional knowledge of life lived on the land, and claims for compensation.

Indeed, for an environmental assessment that had scoped the issue of historical impacts out of the assessment, this issue nevertheless remained a consistent and at times dominant theme throughout the hearings.[4] On the first day of the hearings elder Alfred Baillargeon gave a broad ranging testimony on the impacts of arsenic on water, fish, and people, suggesting that "ever since the White people came into this area and they ruin a lot of land, not only here but other part of the country, and they spoil everything for the people" (MVEIRB, 2012a, pp. 101–040). Métis elder Ed Jones recalled the death of the cattle on the local dairy farm in 1949, seeing tailings flowing into Back Bay in 1949, and the warning signs posted along the shoreline in Latham Island (an Aboriginal settlement across the bay from the mine) (MVEIRB, 2012a, pp. 121–22). The next day Yellowknives TK Specialist Randy Freeman described how the Yellowknives based their "cultural essence" partly on caribou but also on the very productive inconnu fishery in the Yellowknife Bay and River, and thus the impacts on this fishery had been profound (MVEIRB, 2012b, p. 242). Susan Enge from the North Slave Métis asked the remediation team directly how it would address historical impacts of the mine; the team responded that they could not because the issue was outside the scope of the environmental assessment (MVEIRB, 2012b, p. 200).

The second day of the hearing featured elders' appearances at the regular daytime hearings and an evening forum in Dettah, and thus included some of the most detailed and impassioned testimony of the four days. Isadore Tsetta, Chair of the Yellowknives Elders' Senate, spoke of the loss of fishing, medicinal plants, and drinking water. On the latter point, Tsetta specified, "we as a community of Dettah, we know that we can't have drinking water—we can't go to the shore and get a pail of water, and drink from it" (MVEIRB, 2012c, p. 180). Michele Paper, at 99 years of age one of the last elders to experience the advent of mining as a young man, spoke at length about his livelihood based on caribou other wildlife. He recalled fishing and picking blueberries along Baker Creek, and also his first encounters with wage labour working at the Burwash, Con, Negus, and Giant Mines. He also addressed the broader economic and environment injustice associated with the mine: "And billion—a million dollars has been took out from the underground. And we as a Dene people, we're suffering from this, and the money that [is] being shipped down. And we're still pitiful in the community. We're still hurting" (MVEIRB, 2012c, p. 188). George Tatsiechele recalled the feet of sled dogs becoming "raw" after travelling across the Giant Mine site in the 1960s (MVEIRB, 2012c, p. 390). Eddie Sikyea described the contamination of Baker Creek and health impacts on community members, including the deaths of two children (MVEIRB, 2012c, p. 394).[5]

Younger community leaders also ensured that the historical impacts from the mine could not be wholly ignored during the hearings. Former chief Fred Sangris offered broad ranging testimony that included comments about traditional use of fish and the subsequent impacts of arsenic, including the deaths of children and a rise in cancer rates (MVEIRB, 2012c, pp. 352–369). Mary Rose Sundberg talked of the emotional impact of worrying about the site, especially the threat of underground arsenic, the history of health impacts, and the potential impact of surface dust from the site (MVEIRB, 2012c, pp. 344–352). Peter Liske suggested that accumulated experience from many community members indicated that the land had been ruined for a 30 mile radius around Giant Mine. He also submitted to the public record from letters elders and chiefs had written to the Indian Affairs Ministers in the 1970s and 1990s regarding water quality and the pressing need for reclamation activities, providing historical context to the long-standing struggle by the Yellowknives community for some official recognition of their claims to compensation and some measure of control over how the mine will be remediated (MVEIRB, 2012c, pp. 378–388). Taken together, all of this testimony suggests that for the Yellowknives, traditional knowledge of the land and the historical experience of mine development (along with its attendant social, economic and environmental injustices) cannot be neatly separated from one another.

The Yellowknives drew on their historical ties to the land to advocate for an environmental restoration standard to something approaching the land's original condition, rather than what YKDFN Lands and Environment staff member Todd Slack called the "low bar" of the industrial standard (MVEIRB, 2012c, p. 177). Isadore Tsetta captured this sentiment when he declared, "we want to get everything as—as it once [was]. That's important for us, so we want to work with people that are working on this development" (MVEIRB, 2012c, p. 181). Or, as Fred Sangris stressed, the goal should be "to restore the land to its original condition, it might not even be close, but the Yellowknives need to be involved with full traditional knowledge, their knowledge, and how they can help with remediation" (MVEIRB, 2012c, p. 367). The North Slave Métis adopted much the same argument, recommending that surface remediation consider "cultural preferences" and that "pre-contact" conditions should be the baseline for the remediation project (MVEIRB, 2012c, p. 207).

Despite repeated assurances from the proponents that they sought more inclusion of Aboriginal knowledge, the remediation team largely rejected the idea that historical memory and TK should guide remediation goals. On the final day of hearings, Katherine Enns, a technical advisor for the Review Board, asked Joanna Ankersmit, Director of AANDC's Northern Contaminated Sites Program, if she would consider mobilizing TK to reconstruct plant communities and monitor human health, as had been done during the restoration of land around the smelter at Trail, British

[4] The hearings took place from September 11–13, 2012.

[5] We have uncovered archival documentation of one of these deaths (Sandlos and Keeling, 2012b).

Columbia. Ankersmit replied that, "that level of—of study that you are referring to just simply is not within the mandate of this remediation project." The Giant Mine remediation proponents remained leery about placing TK at the centre of the project design even after days of testimony purporting to want more involvement for First Nations in the restoration of their traditional land (MVEIRB, 2012d, 186–187).

The idea that the land should be returned to its former condition infused more specific claims and criticisms among the Yellowknives. Throughout the hearings, for example, there was widespread consensus that the Giant Mine Remediation Team should regard the frozen block method of containing underground arsenic as only an interim rather than permanent solution to the problem. TK Specialist Randy Freeman summed up this sentiment when he claimed that "Yellowknives Dene First Nation want the arsenic to be removed, the hazard mitigated, and the land made safe. Simply freezing arsenic is not a viable alternative for—for perpetuity" (MVEIRB, 2012c, p. 164). Many Yellowknives also expressed their longstanding objection to paying for trucked in water because the bay water had been polluted. With reference to the historical legacy of the Giant Mine, Mary Rose Sundberg argued that "the government has allowed this [the pollution] to happen. They should allow us to have free water forever. It's only right. Why do we have to pay for water delivery every month?" (MVEIRB, 2012c, 348). For many of the elders, the complaint about the monthly cost of water was rooted in the idea that the project should, in one way or another, restore access to a resource that was freely available as commons prior to the mine.

There was also intense concern among YKDFN members about facets of the remediation project that might actually compound the historical cumulative effects of mining. Several YKDFN members questioned, for instance, whether the proposed method of treating mine water would add to the dangers from pre-existing water pollution in the bay. According to the remediation plan, treated water would no longer be discharged into Baker Creek (which drains adjacent to Giant Mine) but be emitted directly into Back Bay through a diffuser (meant to quickly dilute the effluent) that would meet Canadian Council on Ministers of the Environment (CCME) guidelines protecting aquatic life (5 μg/l) outside of a designated mixing zone. Although the diffuser would reduce overall arsenic loading in the bay, the Yellowknives were concerned about pollution levels in the diffuser mixing zone—sometimes referring to it as the "dead zone"—and the fact it was to be placed somewhere close to Latham Island (and the YKDFN community of Ndilo) (MVEIRB, 2012b, p. 175). Fred Sangris claimed that the diffuser would have a substantial impact on aquatic life because it would be right in the path of fish migrating into the bay (MVEIRB, 2012b, 252). Alfred Baillargeon said simply that, "If you guys do the diffuser over there, you guys are going to kill a lot of things" (MVEIRB, 2012c, p. 372). Whatever the impact of the diffuser, the likely root of mistrust over the issue was revealed when Review Board member Danny Bayha received a negative answer to his question about whether anyone from Ndilo had been consulted about the diffuser (MVEIRB, 2012c, p. 234).

These concerns about water pollution dovetailed with long-standing anxiety about the long term health impacts of arsenic exposure, particularly due to traditional land uses involving water and wildlife in the area. Early in the hearings Randy Freeman indicated that baseline health studies would help reassure the Yellowknives that project activities would not add to the historical burden of arsenic exposure in the region. When Joanna Ankersmit countered that the remediation team had done adequate risk assessments for the project (based primarily on modelling) and could not conduct a health study, Freeman noted that the Canada-Déline Uranium Table had included health studies and community healing as a major component of the remediation process for the Great Bear Lake radium/uranium mines (MVEIRB, 2012b, p. 186–189). Peter Liske was even more pointed when he asked for funding to conduct a range of studies: "if . . . Yellowknives Dene First Nation hired their own consultants or their own doctors and do our own studies to our own satisfaction" (MVEIRB, 2012c, 386). An overarching demand from all participants in the hearings was for the creation of an independent oversight body to ensure that health and environmental commitments are adequately monitored and mitigated during the life of the remediation project. For the Yellowknives in particular, it is hardly surprising they do not trust AANDC to regulate the project; not only is the department the project proponent and de facto regulator, but the Yellowknives are starkly aware it was the federal government that had utterly failed to protect their health and the environment in the early years of the mine (YKDFN, 2012).

For the most part, YKDFN members found a very receptive audience for their position among Mackenzie Valley Environmental Impact Review Board members, many of whom, as mentioned above, came from the Yellowknives or other NWT Aboriginal communities.[6] On the third day of the hearings, for instance, board members James Wah-Shee, Richard Mercredi, and Rachel Crapeau (a member of the Yellowknives Dene First Nation) emphasized how much they appreciated the presentations from Yellowknives elders, and also from the North Slave Métis. Wah-shee suggested that the presentations gave a "new perspective" while Rachel Crapeau stated that

> we really appreciate that we—we heard all your information, your concern. When we hear information like that about grandmother, grandfather, their parents, how we used to live near the shore, people used to live a healthy lifestyle.
>
> I want us to work on this report right away so we can make a decision right away, but—but we—we have to work together in order to achieve our goal, to make a sound decision. And we have to think of ways of—to go back to living healthy (MVEIRB, 2012c, p. 217).

2.3. TK and the final environmental assessment report

The final report certainly reflected the concerns of YKDFN members and is a testament to their ability to use the democratic space afforded by the EA hearings to integrate their historical experience and TK with their political critiques of the Giant Mine Remediation Project. While the Review Board report acknowledged that the historical mine activities were outside the scope of the project, it acknowledged that dismissing the YKDFN historical experience ignored community concerns about the cumulative impacts of the remediation activities, and how current fears about arsenic are grounded in prior experiences with sickness and death in the community (MVEIRB, 2013, p. 26, 103). The report also included a lengthy section on the potential impacts of the remediation project on traditional land uses, as well as a formal suggestion for further consultation with Aboriginal groups to address these concerns (MVEIRB, 2013, p. 181–187). The report was highly critical of AANDC's failure, as the department responsible for Aboriginal affairs, to engage Aboriginal communities on traditional uses, stating that "it is not clear to the Board why AANDC did not consult communities regarding potential impact to traditional use, and why it reached impact predictions that were so

[6] Although it is fair to note that YKDFN and NSMA members did not always present a unified front at the hearings, and NSMA in some cases were criticized by board members (particularly Chair Richard Edjericon who accused them at times of political posturing). Some of the Métis demands for a stake in the land caused considerable consternation among the YKDFN elders, who claimed the Métis were outsiders from Fort Chipewyan making claims on their territory.

far from the evidence presented by the traditional land users themselves" (MVEIRB, 2013, p. 198). The report concluded that impacts on traditional use would be mitigated through several required measures: broad health monitoring in Ndilo, Dettah, and Yellowknife; a quantitative health risk assessment, consultation with YKDFN and City of Yellowknife about land uses at the site, establishment of an independent monitoring board, reductions in arsenic loading in Back Bay (to YKDFN recommended levels through the addition of an ion exchange process to the water treatment plant), removal of contaminated fish habitat due to the rerouting of Baker Creek, and periodic reviews to find a permanent solution to the underground arsenic issue. Several of the report's formal suggestions addressed historical issues more directly, including the creation of a monument to past arsenic exposure in Aboriginal communities and the creation of education material for schools as means of commemorating the history of the site (MVEIRB, 2013).

While the EA report offered some victories for Aboriginal communities, especially on the all-important issue of water quality in Back Bay, it is also surprising how little TK is mentioned or incorporated in the final report. Indeed, the words "traditional knowledge" are only mentioned a few times in the report, with much of the discussion on Aboriginal issues reduced once again to traditional land uses. In other words, Aboriginal knowledge remained, to an extent, confined to the traditional activities of harvesting; almost nowhere did the report mandate or even mention the ways that TK, and the values embedded in such knowledge systems, might inform technical aspects of the project such as arsenic storage or surface remediation. Even one of the measures designed to mitigate impacts on traditional fish harvesters—the rerouting of Baker Creek as a means to prevent fish from accessing contaminated habitat—seemed during the hearings to be an idea emanating from Review Board staff rather than Aboriginal elders; it represented an engineered solution with little or no incorporation of traditional knowledge. Nor does the report recommend specifically that TK should be incorporated into the independent oversight body or the health studies (though this may be achieved in part through consultative processes). Above all, the EA was unable to address the fundamental issues of restorative justice that remained outside the assessment mandate: the water payment issue, the compensation and apology, and the full restoration of the land to something approximating its pre-mining condition. In other words, there remained throughout the EA many conceptual and administrative barriers to the full incorporation of TK, especially knowledge that extended beyond "traditional" harvesting activities to encompass the full range of historical industrial impacts experience by Aboriginal communities around Yellowknife.

3. Conclusion

The northward thrust of extractive development forecast for coming decades suggests that concern and conflict surrounding both the immediate environmental impacts and long-term legacies of such development will continue to grow. These legacies are of particular concern to northern Aboriginal communities, who have often borne the brunt of the negative environmental and social aspects of extractive developments. This paper examined the role of Aboriginal traditional knowledge in the assessment of extractive developments in the North, with an emphasis on environmental remediation. Recent critical research points to the "shallow" nature of engagement with traditional knowledge, notwithstanding the growing institutional recognition of its importance to socially just and environmentally sustainable development in the region. Our review of this research argues this shallow engagement reflects the "confinement" of TK to matters relating to local, historical, and non-industrial activities, and to biotic, rather than non-renewable resources.

The Giant Mine case illustrates the similarly problematic nature of how traditional knowledge is defined and deployed in the remediation and management of extractive industry's long-term legacies. Remediation represents a distinct phase of extractive development, since it deals with the reclamation of landscapes degraded by past activities, yet legacy mine lands (like their original developments) "span a continuum of environmental and socioeconomic impacts" (Worrall et al., 2009, p. 1429). The experience of the Yellowknives Dene exemplifies the "containment" of traditional knowledge to matters of local ecological knowledge and its exclusion from remediation issues deemed technical or scientific. Equally problematic was the role of AANDC, and to some extent the Mackenzie Valley Environmental Impact Review Board, in "scoping out" questions of the collective history and personal experiences of Yellowknives Dene related to the health and environmental impacts of the Giant Mine. As Cassady (2007, 94) suggested in relation to Inupiat experiences of radiological wastes, "by clinging to a narrow definition of what constitutes 'tradition,' and what constitutes 'knowledge,' we have failed to develop a rich, culturally informed and historically specific understanding" of contemporary Indigenous experiences of environmental hazards. The result echoes what Fricker (2007) has called epistemic injustice, where marginalized social groups cannot render intelligible their respective experience and perspectives on terms acceptable to the dominant culture.[7] In the case of mine remediation, we suggest that Indigenous knowledge is often caught between complex technical discourses meant to address engineered solutions to environmental legacies and the practice of scoping out historic economic and environmental injustices deemed irrelevant to remediation processes that are meant to be solution-oriented, consensual, and apolitical.

Reflecting on the intersections between science and oral history in Alaska, anthropologist Julie Cruikshank suggests that "we need to enlarge spaces for local knowledge by taking into account those generative sources of meaning that make no sharp separation between changing biophysical worlds and changing social worlds" (Cruikshank, 2005, p. 257) Similarly, the comments of Aboriginal people at the Giant Mine EA hearings echo Cruikshank's contention that TK should not be considered merely a synonym for "traditional" land use, but can embody the political critiques and historical experiences of environmental injustice that Aboriginal communities have contended with in the face of rapid development projects (also cf. Loo, 2007). Certainly one lesson of the Giant Mine Remediation Project is that attempts to subsume this knowledge within highly technical processes is bound to reinforce feelings of mistrust and alienation among the Aboriginal communities which ultimately have the greatest stake in healing the landscapes they regard as home.

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[7] Fricker distinguishes between testimonial injustice, where a speaker is accorded diminished credibility by the hearer to prejudice (race, gender, etc.), and hermeneutical injustice, where the speaker and hearer cannot comprehend one another due to widely divergent worldviews and experience. In cases of unequal power relations, it is the members of a marginalized social group who become ignored due to hermeneutical injustice. Our case study on Giant Mine suggests that in many cases the testimony of Aboriginal people was accorded a high degree of respect and credibility, but in many cases regulatory authorities were unable (for conceptual and procedural reasons) to fully address the issues and concerns embodied in this testimony.

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