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Trust in numbers: Serious numbers and speculative fictions in rare earth elements exploration

Tom Özden-Schilling

Abstract

In the early 2010s, a spectacular fall in prices for a class of mineral commodities called the rare earth elements (REEs) and the collapse of hundreds of new exploration companies made clear the fragility of the high-risk markets around these companies and the strategies of legitimation that supported them. New regulatory processes built around technical disclosures generated vast stores of geotechnical data. Rather than generating trust among market actors, however, these processes dramatically altered the temporalities of global extraction and energized unruly narrative spaces. In their efforts to keep mineral claims active and companies afloat, REE-focused exploration experts have struggled to navigate different arenas of discussion while holding their respective logics in tension. Drawing on ethnographic fieldwork with exploration geologists and promoters, this article examines how experts federate flows of 'serious' and 'speculative' information in both carefully regulated reports and rumor-filled online forums. Such spaces are organized by aesthetic conventions and social criteria for establishing persuasiveness—forms that STS scholars have long analyzed as literary technologies. Rather than helping to secure experts' authority, however, I argue that the diverse literary technologies that now dominate exploration promotion and finance work have radically redistributed interpretive roles. In their struggles to mediate senses of 'crisis' endemic within venture markets, exploration experts must enact the ideals undergirding new regulatory requirements even as they learn to defer to the speculative musings of others.

Keywords

speculation, finance, valuation, commodities, geology, trust

National University of Singapore, Singapore

Correspondence to:
Tom Özden-Schilling, Department of Sociology and Anthropology, National University of Singapore, 11 Arts Link, #03-06 AS1, 117573, Singapore.
Email: tos@nus.edu.sg

I told her a good story is selling, so I could sell these good ideas from the Yukon—and then the Bre-*X scandal hit … and there went the idea of a good story selling.*

—Geologist Shawn Ryan, on the inspiration that drew him and his wife into mineral prospecting in the early 1990s (in Gahr, 2011).

'Nobody actually reads the reports, but the numbers will be all over the internet by lunch. That's the goal, anyway.' Jack, a director at Mercantile Minerals, was sanguine as we rode the elevator up to the office to start the day.[1] The exploration field report for the Nunavik deposit, Mercantile's flagship rare earth elements (REE) prospect in northern Quebec, Canada, would be posted online at 8 AM. The past summer, Mercantile had paid drilling crews $12 million to extract core samples from sites spread across the 190 square kilometer expanse of their Nunavik exploration claim area. Eleanor, Mercantile's chief geologist, had been on the phone every day for the past month from the company's headquarters in downtown Vancouver. Each morning, she had been enmeshed in conversations with consultants, auditors, and other geotechnical experts about the data that the company was acquiring to estimate the total volume of ore that a future mine at the site might produce. Extrapolating sample results alongside then-current REE market prices and the likely cost of future mining operations, one consulting firm had projected a net present value for the total project of $2.3 billion, commensurate with the most lucrative REE mines on earth. The resulting 219-page exploration field report, the company's biggest press release of the year, was replete with painstaking explanations of the company's drilling procedures and the analytical processes used to estimate future production volumes and profits. As Jack and Mercantile's team of investor relations specialists spent the morning phoning hundreds of contacts to announce the report's release, though, many in the office wondered aloud if it was more data that investors were looking for.

By lunchtime, the phones had quieted down. Jack had retreated to his office overlooking Howe Street—the epicenter of Vancouver's mineral exploration industry—and was busily trawling the internet. Like many of the potential investors that Mercantile staff had called over the morning, though, Jack was looking not for more data, but for stories. Over the past three years, it had become something of a tradition: After each press release, Jack would seek out blog posts about developments at other mineral exploration sites, technology news items, and other narratives to post to the Rare Earth Elements discussion group, an invitation-only list that he created on the social networking site LinkedIn in 2010 and had moderated since. With over seven thousand members, the group was (and as of 2023, remains) the largest single online discussion venue devoted to REE industry news and gossip. Logging in from corporate and government offices, and, for the many self-employed prospectors in the group, their own homes, geologists, prospective investors, so-called technology pundits, and other group members discussed stock prices for dozens of different REE exploration ventures. They shared links to articles about international mining policies and emergent technologies, celebrating designs that utilized REE-based materials or advancements in chemical processing techniques that might open pathways to previously inaccessible ores. Several times per month, forum discussions drifted into more fantastical topics, from theories about international

trade conspiracies to debates over the plausibility of constructing mines on the moon (see Klinger, 2017). Jack often joked with Eleanor and other Mercantile staff about the ease with which forum posters associated such 'speculative fictions', as he called them, with reports from Mercantile's Nunavik deposit and other 'serious projects'. Yet as Mercantile's stock price hovered at $0.15 per share—down almost 99% from the previous summer—Jack was learning to leave some of these fantasies intact.

Like many people working for mineral exploration firms, Jack navigated different genres of documentation and discussion with the goal of differentiating Mercantile's approach to its project from the 'destructive' speculation for which the Canadian mineral exploration industry had long been infamous (Armstrong, 1997; Majury, 2014; see also Preda, 2009). The distinction had become a crucial one on the TSX-V, an electronic venture exchange listing more mineral exploration companies than any other exchange in the world. Opened by the Toronto Stock Exchange in 1999 as a replacement for the Vancouver Stock Exchange and several other regional exchanges focused on low-capitalization firms, the TSX-V presents itself as a sophisticated yet accessible exchange, one that painstakingly regulates its issuers even as it offers small-scale investors the excitement of high-risk ventures. All exploration companies listed on the exchange are governed by meticulous rules for disclosing and auditing their geotechnical data. Some companies have embraced these rules and treated third-party technical reports on their prospects as promotional materials. In recent years, though, fluctuating commodity prices and regulatory regimes have dramatically altered the temporalities of global extraction (Ferry & Limbert, 2008; Weszkalnys, 2015; Wood, 2016). For mineral deposits in North America, industry advocates complain, exploration companies now require more than a decade to 'prove up' prospects into producing mines (Schilling, 2013). Promoters of 'serious projects', Jack and others lament, are struggling to hold the interest of restless investors.

For a brief period, the emergence of REE exploration ventures seemed to promise promoters new terms for assuaging investors' impatience. Between 2010 and 2011, a dramatic surge in prices for REE-based materials caused initially by the imposition of new quotas on REE ore exports from China—the only major producer of REEs when I began visiting Mercantile's offices in 2012—brought hundreds of new REE-focused exploration companies into existence (Bradsher, 2010).[2] Promotional campaigns highlighted the crucial roles that the materials played in the construction of car batteries, wind turbines, smartphone chips, and other sophisticated technologies. Even after REE export quotas were abandoned by the Chinese Commerce Ministry in 2015 after dozens of countries complained to the World Trade Organization (see Areddy & Yap, 2012), exploration promoters continued to present the search for North American REE deposits as a moral and patriotic duty (Klinger, 2017).

The rapid pace of REE-based technology development meant that prospective investors would stand to benefit from 'disruptive' innovations across a range of emergent industries, promoters insisted, all driven by the 'move fast and break things' (Taplin, 2017) ethos promulgated by Silicon Valley start-up companies. The vague and open-ended nature of promoters' assurances, though, caused information about REE prospects to circulate in unruly ways. Thanks to the complexity of REE mineralogy, non-specialist market participants were heavily dependent on expert interpretation for understanding

the feasibility and possible evolution of REE metallurgical processing and materials design. Meanwhile, these same technical complexities and indeterminacies greatly increased the popularity of newsletters, blogs and other online discussion spaces run by non-specialists, which together helped to keep apocryphal information in circulation. By the time I began meeting Mercantile staff in 2012, federating these flows of information and enthusiasm had long since become a full-time task.

Literary technologies in crisis

Jack's dilemma exemplifies a challenge facing thousands of experts whose working lives have become enmeshed in venture capital markets. In recent decades, the erosion of longstanding regulatory regimes designed to separate high-risk investments from other domains of finance has led government institutions to devise new ways of reassuring prospective investors that their money can be invested rationally in these markets (Bear, 2020; Souleles, 2019). Rather than emphasizing the inherent risks underlying these markets and their issuers, Canadian regulators have largely problematized the trustworthiness of individual experts and spokespeople, and treated investors as dispassionate and objective consumers of the knowledge that exploration experts produce. New disclosure and auditing procedures have generated vast stores of geotechnical data organized within newly formalized genres of documentation (Majury, 2007). Experts' efforts to circulate these data, though, have also generated new opportunities for comparison and apocrypha, particularly in online discussion spaces where prospective investors share stories and interact (Tsing, 2000). Meanwhile, thousands of geologists and promoters working for mineral exploration companies have found themselves mediating new kinds of 'serious' and 'speculative' information even as they face new uncertainties at multiple scales—from the accuracy of specific geological assessments to the fate of the entire TSX-V. In their efforts to keep mineral claims active and companies afloat, many experts have struggled to navigate both arenas of discussion while holding their conflicting logics in tension.

The demands facing contemporary exploration experts highlight the challenge in emphasizing legitimation as a foundational problem for critical studies of expertise—a tendency that STS shares with a long line of financial policymakers. For nearly a century, Majury (2014, p. 545) argues, the 'notion of "disclosure"'—the regulated reportage of a firm's transactions and analytical activity—has played a central role in the 'construction and legitimization' of Canadian markets. As new kinds of venture capital exchanges and new commodities with amorphous technological horizons have emerged in the twenty-first century, however, the roles that individual experts play in legitimizing these markets have grown more complex. As I describe below, the Canadian Securities Administrators (CSA) imposed new technical disclosure and data sharing mandates in 1999 after revelations of fraud at a gold prospect in Indonesia left thousands of shareholders with spectacular losses (Symonds, 1997). More recently, other federal and provincial governing bodies have also introduced tax incentives for venture stock purchases, and funded media campaigns championing mineral prospecting as the 'new bedrock of Canada's economy' (Isfeld, 2014; see also Stanley, 2016).

These efforts have brought new kinds of investors into venture markets like the TSX-V, but they have also deepened what many prominent market analysts describe as an intractable sense of 'crisis': The novice investors who now dominate these markets, analysts insist, are either unable or unwilling to discern the difference between 'serious' exploration projects and superficial prospects with no real chance at development (Long, 2013). This divergence has profoundly affected experts' approaches for cultivating confidence and trust. Even as regulatory institutions prescribe ever-more laborious measures for certifying technical knowledge, in other words, these same institutions' prevailing interest in keeping venture capitalism in motion has rendered individual experts tacitly responsible for enabling unregulated arenas of discussion to proliferate—arenas where prospective investors might form affective attachments to 'serious' prospects by engaging in speculative comparisons.

How exploration experts have narrativized and responded to the 'crisis' can show us how expert institutions use documentary forms to respond to questions of truth and legitimacy. Shapin and Schaffer (1985) argue that the emergence of the 'experimental report' was intimately shaped by natural philosophers' anxieties around the English Civil War and Restoration. Early modern experimentalists, they show, decried logical argumentation for according too much authority to artful rhetoric. Physical demonstrations, meanwhile, were prized among experimentalists because they could be dispassionately recounted through pictures, procedural notes, and detailed first-hand accounts, which could then facilitate the 'virtual witnessing' of the same experiment by theoretically infinite publics.

Different domains of knowledge production have known different histories of witnessing. Industrial mining has always relied on novel observational techniques, representational schema, and social arrangements to enable investors and regulators to put trust in the knowledge that geologists and mining engineers produce while 'seeing underground' (Nystrom, 2014), in part to combat historic associations with fraud (D'Avignon, 2022). Across different domains, though, the social, material, and representational elements of witnessing are often interwoven in ways that reflect broader institutional anxieties. Shapin and Schaffer define the combination of representational artifacts relevant to early modern experimentalism, along with the specific genre conventions and mechanisms of circulation shaping their production and reception, as a 'literary technology'. Deployed properly, Shapin (1984, p. 497) argues, the literary technology of the experimental report 'dramatized the social relations proper to a community of experimental philosophers'—a 'social technology' that had to be put into place to validate experimentally produced knowledge. As an exponent of a highly particularized social technology and the concrete 'material technology' of the experimental apparatus and its associated artifacts, experimental reports helped to certify bodies of knowledge and reinforce the authority of an emerging class of natural philosophers. In some cases, Shapin and Schaffer argue, the interlinked dependency of these technologies could even secure futures for public institutions, particularly when the authority of experts is called into question during broader societal crises.

Historians of science, scholars of literature and information studies, and others writing for a wide array of other fields have deployed the concept of literary technologies to describe how communication conventions redistribute power by tethering institutional

legitimacy to behavioral norms. Not all of these redistributions are hegemonic. Wylie and her co-authors, for instance, describe how the material architectures and narrative conventions surrounding open source software enable citizen scientists, builders of environmental monitoring tools, and other politically engaged 'makers' to secure critical forms of authority outside conventional centers of technoscientific control (Wylie et al., 2014). Other scholars turn to genres beyond scientific writing to emphasize the emotional bonds between author and audience that literary technologies engender—bonds that encourage readers to develop their own 'mental images' of characters and scenes that become fundamental to the persuasiveness of texts. Describing the stylistic devices characteristic of Early Modern romance literature, Robinson (2017) emphasizes how the affective interplay facilitated by familiar tropes allow authors to capture readers' attention: 'Romance reading … is a sentimental education, a literary technology through which affective response is solicited, shaped, and transmitted, a continual practice in producing—and interpreting—"lively" images of the minds of others' (p. 245). Even as readers' imaginations run wild, Robinson suggests, the worlds that emerge in their thoughts still take the shape of the author's designs.

While scholars have examined literary technologies across an enormous range of knowledge practices and sociohistorical contexts, the conceptualizations of authorship underlying these explorations often echo Shapin and Schaffer's original portrait of Boyle: namely, a unified author whose power and persuasiveness derived from his ability to subsume a multitude of perspectives into 'privileged zones of "objective" reality' (Haraway, 1997, p. 26). In these treatments, both fact-making and speculation remain the province of individual authors. For Shapin and Schaffer (1985), 'speculative' narratives—tentative descriptions of experimental events and self-effacing guesses at causal mechanisms—are presented as strategic performances of modesty designed to secure the good faith of distant audiences, not as actual extensions of interpretive agency.

As this article aims to show, speculative narratives can play a wide range of roles in securing links between literary, material, and social technologies, but the agentive relationships they establish between authors and audiences are far from unidirectional. For Shapin and Schaffer, the narrative speculations of experimentalists were particularly important to securing a sense of concreteness around the 'material technology' of an experimental demonstration. In other analyses of communication practices of the same period, though, the power of speculation and suggestive guessing threatened to turn on established authors. The eighteenth-century English usage of the term 'speculation' began to take on the financial connotations now familiar to contemporary ears: as a means of describing purchases motivated by expectations of changes in value, as well as whatever storytelling feints were required to make these purchases possible. By the eighteenth century, Ferry (2020, p. 97) observes in an etymological study, definitions of the word 'fold[ed] together several earlier aspects of [the word's] meaning, including anticipation of the future, watchful consideration and calculation, and uncertainty, lack of substance, or even falsity. Defined in this way, the concept of speculation appears to exclude substance and materiality.'

Tracking the broader set of associations that travel with references to speculation is important for understanding how different audiences engage with narratives about events that they did not personally observe. One might assume that participating in this

interpretive work concretizes knowledge claims and legitimizes their original authors. However, the interactions that I observed between geotechnical experts and prospective investors made it clear that the empirical data produced through exploration work are often more interesting to many market actors as texturing devices for evocative comparisons and suggestive storytelling than as anchors for objective reality. This distinction is especially crucial in settings where expert statements can become linked to processes of valuation, and where the experts in question are constrained not only by local behavioral norms (see Schaffer, 1998), but also by elaborate legal rules.

As Ferry shows through her analysis of precious metals mining and marketization, the lingering association between speculation and *immateriality* continues to have tremendous consequences for how (and whether) the artifacts and practices associated with speculative narratives come to be understood in ethical terms (see also Bear, 2020). This kind of tension affects all mineral prospects, which must be subject to physical sampling processes before becoming legible as vehicles of investment, since each phase of these sampling processes generates documents that may circulate as components of speculative narratives (Schilling, 2013; Weszkalnys, 2015; Wood, 2016). Rather than naturalizing the material backdrop of a story by facilitating virtual witnessing, in other words, narratives that come to be marked as speculative can also transform otherwise trivial 'concrete' details into suspicious signs of artifice and immateriality.

Examining the diversity of ways that speculative narratives can subvert and refashion the original designs of literary technologies shows how quickly questions of authorship, documents, and institutional legitimacy can move beyond the consolidation of individual authority. This is particularly true among financial experts. In their analyses of the materiality and formal structure of financial documents, ethnographers have devoted increasing attention to subtle differences between market actors' disciplinary backgrounds and their professional roles within their respective institutions (Holmes, 2009; MacKenzie, 2003; Riles, 2010). Analysts, traders, economists, policymakers, auditors, and other actors each have different ways of conceptualizing how their expertise relates to a broader moral authority amongst their colleagues and the world at large (Leins, 2022; Miyazaki, 2006; Souleles, 2019). Differently positioned market actors may also hold divergent understandings of the empirical basis of the knowledge they produce through their work (C. Özden-Schilling, 2021; Zaloom, 2009). Much of this scholarship, however, focuses on concepts and practices relevant to emerging and established markets, rather than faltering exchanges where actors' communicative actions are already clouded by doubt and dread. Particularly within fast-moving venture capital markets, much of this dread focuses on the possibility of 'spooking' investors, who may be inclined to treat practically any narrative or technical detail as evidence that company experts are only 'telling stories' (Miyazaki, 2006).

Since the beginning of the twenty-first century, complaints about Canadian venture markets in 'crisis' have weighed on experts' everyday practices and provided convenient frames for state intervention (see Roitman, 2014). Meanwhile, though, the concept of literary technologies has become an uncannily accurate heuristic for understanding policymakers' efforts to engineer public trust into existence. As I describe in the following section, Canadian regulators have effectively followed the ideals that Shapin and Schaffer ascribe to gentlemanly science by emphasizing the need for accessibility and detail in

technical documents like Mercantile's field report, and by elaborating rules for the 'qualified persons' who are legally responsible for the accuracy of these documents. These rules, which emphasize professional credentials and work history but also include tests of personal character, have reshaped the day-to-day work of thousands of exploration experts. Mercantile staff regularly produce geotechnical models, financial statements, and numerous other kinds of artifacts to document their work on the Nunavik project, and they constantly reference them while speaking with prospective investors. In addition to using these documents to create a sense of 'objective reality' around their prized prospect by naturalizing their observations and analytical skill, however, Mercantile personnel also deliberately hold back aspects of their own interpretations in order to encourage others to develop their own narratives, including by crafting comparisons with other prospects that Mercantile experts are often not allowed to articulate themselves.

Canadian regulators have increasingly treated individual experts who author and authorize documents as singular moral agents capable of legitimizing venture finance as a governable space. Geologists and other industry professionals, meanwhile, have become increasingly reticent to link the future existence of the TSX-V to their ability to gain shareholders' trust (see also Jiménez, 2011; Mackenzie, 2001). As the following section shows, this divergence has caused new literary technologies to proliferate throughout the mineral exploration industry, each one carrying new affordances and demands for 'qualified persons' at companies like Mercantile. Over the course of several months, I observed how Jack, Eleanor, and their colleagues tacitly facilitated comparisons between vetted prospects and apparent fantasies, particularly within discussion threads attached to the tutorials that Jack organized to help other LinkedIn group members parse REE-related technical subjects. By presenting links to 'serious' discussions of exploration science and finance side-by-side with sensational conjectures, Mercantile staff enacted imaginative spaces in which the tedious and time-consuming work of filing disclosures and 'proving up' prospects into producing mines had all but disappeared. Yet in deferring their own epistemic authority in order to retain the attention of restless investors, these exploration experts exposed an irreducible tension underlying contemporary venture capitalism. Despite bearing legal responsibility for the accuracy of the geotechnical analyses upon which the legitimacy of the TSX-V had come to depend, Mercantile staff resigned themselves to the fact that ailing Canadian venture markets needed other people's stories to keep them alive.

Serious ventures

During the months I spent working at Mercantile headquarters, I routinely heard geologists and promoters describe the prolonged doldrums affecting the TSX-V as the result of a 'trust gap' between investors and industry experts. Many of these same experts, however, also bemoaned the regulatory measures introduced to remedy this 'gap' for misrecognizing how field reports, company prospectuses, and other technical documents enabled them to craft relationships with other market actors. These documents, much like the kinds of relationships that Mercantile's experts sought to cultivate with other actors, were diverse. Ranging from highly publicized geological assessments, online project updates, and advertisements to the more mundane realm of inter-office emails

and regulatory filings, each of the literary technologies relevant to Mercantile's exploration work combined numbers, images, and narratives to convey the Nunavik deposit as a simultaneously exciting and accessible prospect. Each audience, though, had specific demands. Current and prospective investors, corporate sponsors, government regulators, analysts for private capital firms, geotechnical consulting experts, and staff from other REE-focused exploration companies, Eleanor explained, 'all want[ed] to study up on their own terms'. The diversity of literary technologies enabled Mercantile staff to reinforce the interpretive authority of these audiences through different registers of technical detail. Yet each of the literary technologies underlying these exchanges, I soon learned, also deployed starkly different terms for differentiating between speculation and 'serious' investment, and for conveying faith in the TSX-V as a whole.

Like Mercantile, nearly all exploration companies searching for REE ores are 'juniors': small companies, often comprising fewer than a half-dozen geologists and promoters, that hire temporary crews for on-the-ground exploration work and advertise their findings to small-scale investors, partnering firms, and eventually, to the production companies (or 'majors') that will develop the most promising sites into actual mines. Few of the fifteen hundred juniors headquartered in Vancouver own any assets beyond their claim titles and the mineralogical data they obtain through their work. For most companies, though, these data and claims are enough to secure listings on the TSX-V. During recent market spikes for uranium, lithium, and other specialized minerals, several juniors sold claims for hundreds of millions of dollars. Hundreds of others have made profits by selling shares for nascent projects where exploration work had yet to take place.

Historically, juniors have depended heavily on small-scale investors—a dependence that has helped to make exploration markets spectacularly volatile. When I began visiting Mercantile headquarters in 2012, market prices for REEs had fallen into precipitous decline. It had been bold for the company to fund an aggressive exploration program while other exploration companies around the world were 'going into hibernation', Jack admitted. He hoped that the dearth of exploration activity that summer would mean less competition for the attention of prospective investors. In previous years, a glowing field report might have captivated industry blogs and significantly boosted Mercantile's trading volume and stock price. Two years earlier, Mercantile stock had sold for more than $10 per share. By the end of the week that the 2013 field report was posted online, though, the same stock had barely moved from its months-long hold around $0.15. The swoon was only beginning: The ventures exchange as a whole was in the early stages of what has become a decade-long contraction. From a high above 2400 points during the height of the REE investment boom in early 2011, the TSX-V composite index had fallen below 1000 when I last visited Mercantile in late 2013. Months after many REE-focused juniors had seen their stock prices increase more than a hundred-fold, nearly all were trading for pennies per share. Even as other REE juniors ceded their claims and dissolved, though, Mercantile geologists kept insisting that they could 'prove up' the Nunavik project and sell it to a major producer. They simply needed more time.

The conversations I shared with Mercantile staff revealed very different hopes and anxieties than those coloring other public pronouncements about the possible futures facing the REE industry writ large. Even after junior company stock prices declined dramatically from 2012 onward, TSX-V officials continued to hail the rare earths

exploration industry as a model for a new kind of venture capitalism (Kiggins, 2015). For those who invested early and wisely, they insisted, REE projects promised far greater potential value than prospects for conventional commodities whose markets and material applications were already well understood. Some exploration experts I met in Vancouver, however, were reluctant to treat REEs as an exceptional case. While senior Mercantile staff often sought to convince me to see the downturn as a temporary phenomenon, a few occasionally offered additional musings about the fates of the exchanges that had preceded the TSX-V. The Vancouver Stock Exchange (founded in 1906), the Los Angeles Oil Exchange (1899), and the San Francisco Mining Exchange (1862), all established primarily to raise capital for mining, oil, and gas ventures, were among the first exchanges of any kind established west of the Mississippi River. Throughout the twentieth century, these and other exchanges found much of their appeal among small-scale investors who could not afford to buy shares in established companies on the New York Stock Exchange (Armstrong, 1997; Cruise & Griffiths, 1987). Each exchange played host to epoch-defining scandals and frenzies of investment, which subsequently shaped complex debates over the roles that government agencies should play in regulating communications between experts and investors.

Continual shifts in the laws and technical procedures governing exploration company disclosures underscore a persistent lack of consensus among regulators over how to define speculation in either material or ethical terms. In an incisive study of the evolution of exploration finance regulations in Canada, Majury shows how over the past century,

> the practical significance of disclosure as a regulatory technique has been reframed in terms of: firstly, the well-being of Ontario's resource economy; then, wider processes of Canadian industrialisation; and finally, promoting Canadian 'knowledge industries' within the global economy. Each shift in interpretative practice attempted to codify and shape the circulation of information deemed by regulators as 'material' to the valuation of shares. (Majury, 2014, p. 555)

With each shift, the experts who produced and circulated this 'material' information found themselves responsible for securing a broadening array of concerns. Meanwhile, though, the audiences receiving these assurances—and their desires, interests, and technical literacy—steadily diversified.

As disclosure protocols have grown more formal and elaborate, my interlocutors' stories suggested, exploration experts have deployed a shifting array of narrative techniques for eliciting imaginative engagement from different audiences, and from small-scale investors in particular. Shortly before the opening of the TSX-V, when junior firms were just beginning to solicit stock purchases through then-new online investment platforms, Tsing (2000) characterized novice investors' relationships with mineral exploration as a willing capitulation to corporate 'conjurings'. Cultivating a sense of possibility around emergent prospects, she argued, required the deliberate production of vagueness by exploration company personnel, both in terms of geotechnical data as well as geographical setting. The production of new global scales in which a prospect might be evocatively emplaced, Tsing suggests, also depended upon novel forms of charisma made possible through online investment and promotion (Kneas, 2018). Such spaces could not simply be rendered visible through geological analysis, but rather had to be

conjured from frontier narratives woven through the tacit colonial aspirations of North American investors (Braun, 2000; T. Özden-Schilling, 2023).

As Mercantile staff understood well before REE exploration markets began to collapse, the kinds of literary technologies that were useful for conjuring spectacles of adventure and wealth—exciting stories about prospectors' adventures in 'exotic' exploration locales, first-hand accounts of visually spectacular ore samples encountered on site—could also arouse suspicion if similar-sounding stories turned out to be false. In 1997, Bre-X, a Canadian-owned company that purported to be exploring for gold in Indonesia, collapsed amid revelations that the spectacular yields projected for its Busang project were the result of fraudulent sample analyses (Danielson & Whyte, 1997). Investors lost 6 billion Canadian dollars. For months, editorials ruminated on other famous frauds that had rattled Canadian exchanges throughout the century. Some industry journalists projected these anxieties forward, foreboding that a new, highly touted prospect could be 'the next Bre-X' (Symonds, 1997). As the decade drew to a close, hundreds of exploration companies unaffiliated with Bre-X lost their funding and dissolved.

In 1999, the Canadian Securities Administrators (CSA) responded to the collapse by instituting new regulatory measures collectively known as National Instrument 43-101, a classification scheme for publicizing prospects and listing exploration companies on the TSX and other Canadian exchanges. The resulting regulatory regime affected thousands of internationally dispersed companies. 'The Instrument', as it came to be known throughout Canada, standardized formats for public filings and research reports and defined formal categories of investors based on their experience with venture capital markets. Almost immediately, however, the new literary technologies created through the introduction of Instrument-specified document formats generated a split within the social technologies linking exploration experts with prospective investors. Speaking with 'accredited investors', company officials could speculate openly about the future of specific exploration sites, and narrativize personal hopes regarding their development.[2] For the many investors who failed to meet these criteria, promoters and geologists were legally bound to engage with them using only carefully regulated text and speech. Experts were required to explain that imprecise estimations, market changes, or new regulations might delay the development of a prospect suddenly and indefinitely. Everyday conversations about technical work, or even discussions about the possible resumption of work at dormant prospects, had to be checked continuously against formal rules designed to target promising as evidence of potential fraud.

Judging from accounts of the transition offered by geotechnical experts who were already working for exploration firms before the Instrument was introduced, the bifurcation of the social technologies caused by the refashioning of the disclosure process immediately transformed how company staff understood issues of professional legitimacy. As Eleanor wryly put it, many geologists quickly learned to treat the Instrument as little more than 'the promise of a paper trail': a chain of reports which could be used to link specific numbers back to individual, certified experts in the event that a scandal emerged. Yet by standardizing terms and formats for field reports and other research documents, the Instrument also reconfigured the authorial voice of individual geologists, who, as Eleanor lamented, had previously been able to structure their reports as longer

narratives suffused with personal reflections. These narratives had helped make earlier reports more persuasive not only because the rich and evocative detail contained in their site-specific descriptions made the reports 'feel more realistic overall', she lamented, but also because their prosaic qualities made it far more likely that they 'were actually read'.

The ways that Eleanor and other senior geologists lamented the diminished sense of voice they associated with Instrument-era reporting formats sometimes made it challenging to treat them and their younger colleagues as part of the same epistemic community. When I began conducting ethnographic fieldwork in Vancouver in 2011, Mercantile's geologists and other employees had been working with the technical rules and documentary forms of the Instrument for over decade. For many of the company's 'investor relations' specialists, however—young men who spent several hours each morning phoning potential investors—the regulations had been in place for their entire careers. Some seemed to 'almost get uneasy reading the older reports', Eleanor offered half-jokingly, since they had grown so accustomed to seeing reflective language carefully edited out of their own documents. Even as the Instrument divided the social technologies that Mercantile sought to enact into separate domains of accredited and non-specialist investors, in other words, the feelings elicited by this labor also threatened to generate a parallel split within the company itself.

During the months I spent conducting interviews, attending meetings, and helping to assemble financial reports at the company's Vancouver office, I witnessed the emotional build-up preceding new press releases and the let down as each one failed to impact the company's stock price. Each subsequent press release brought new anxieties, too, particularly after dozens of competing exploration projects stalled and other Vancouver-based REE companies began folding in 2013. Initially, I perceived the sarcasm and sudden tone shifts during these periods as evidence that my interlocutors had grown cynical about the 'aesthetics of complexity' (Riles, 2000) that colored the post-Instrument regulatory environment. As I observed the professional pride that Jack, Eleanor, and their colleagues took in the project as a whole, however, I began to register different senses of alienation at play. Few exploration industry professionals, they admitted, helped their companies grow simply by insisting on their status as experts and promoting their work solely through technical reports. In order to satisfy their audiences' urges for both 'serious projects' and 'good stories', Mercantile staff became deft at emphasizing the emergent and uncertain nature of REE-based material uses, processing technologies, and mineralogy. Yet as they developed strategies for displacing the burdens of authorship away from their own documents and into unregulated spaces of discussion, it was becoming less clear what kinds of authority their technical knowledge might connote for investors, particularly if their company did not survive.

Inattention to detail

'You'll learn the language around here pretty soon', an executive from a rival REE exploration company told me shortly after my arrival in Vancouver. 'You'll be able to figure out the difference between a "project" and a *real* project.' Prospects explored by Mercantile Minerals, he begrudgingly admitted, were always 'real projects'. One of the fifteen hundred junior exploration companies headquartered in downtown Vancouver,

Mercantile was known for maximizing control over its exploration claims by attempting to hold on to them all the way through to production. Struggling to explain the company's ethos to me during my first week in the office, a younger Mercantile staff member cited the influence of the technical staff on the company's board of directors. 'Geologists hate killing projects', he sighed, 'because you just don't know!' As the industry as a whole grew increasingly dominated by small companies 'flipping' claims after minimal analytical work ('Two guys in a rented room with a computer and a phone, basically', as the rival executive put it), Mercantile's patient development strategy was becoming more rare.

'Real projects', the executive might have added, accrued material residues that could both help and hinder exploration experts' promotional labor. During the months I spent at Mercantile as an unpaid ethnographic observer, I spent most of my time in the company's 'map room', where I helped staff members copy-edit press releases, update project maps and technical diagrams. Separated by a glass wall from the cluster of cubicles where the 'investor relations' staff spent their mornings phoning potential investors and the sparsely adorned hallways leading to Mercantile executives' harbor-facing offices, the large, cluttered map room resembled the office of an aged geology professor. Boxes of core samples sat atop filing cabinets filled with field reports. Photographs from drilling programs and technical posters from industry conferences adorned the beige walls. Periodically Eleanor would invite prospective partnering firms—including, during my months working in the office, a major electric vehicle manufacturer—to visit company headquarters, where Mercantile executives would pointedly let their guests linger in the map room. The artifacts that had accumulated during years of work at the Nunavik prospect conveyed the company's 'commitment to seeing things through', Eleanor insisted. To some shareholders, though, that sense of commitment also signified indecision, she admitted, 'like the company can't see when it's time to move on'.

Junior Mercantile employees perceived the value of the map room in markedly different registers. For Mercantile's investor relations staff, the rock samples, instruments and other physical apparatuses used in the field during the Nunavik project only became useful to their day-to-day work when narrativized alongside project updates and discussions of industry-wide trends. 'If something comes up [in the news] about tantalum, [Jason] tweets it', one offered. Other artifacts with no direct connection to the physical exploration process, meanwhile, offered affordances for other storytelling processes. Every aspect of the company website was regularly and carefully updated, for instance, another investor relations staff member pointed out, since board-of-director 'bios are essentially marketing objects'.

The divergent senses of value accorded to the material technologies of exploration geology echoed the ambiguous hierarchy linking Mercantile personnel. The unconventional professional backgrounds of the 'non-technical' staff, a few junior employees occasionally boasted, helped them to see opportunities for promotion that other exploration firms might miss. The company's director of communications, for instance, had worked as a jazz guitarist not long before joining the company. Jason, a recent hire who had already become one of Mercantile's most successful representatives, had been bartending only months before I arrived. Both men emphasized to me that their winding professional paths had helped them to understand what kinds of narratives and details

investors 'really want to hear about', and what kinds of technical descriptions turned them away. Their own enthusiasm for Mercantile's projects, they also admitted, sometimes affected other experts they met through their work. One month before I arrived, a group of Mercantile-hired geological consultants had gotten the company fined for posting pictures of new core samples on their personal Facebook pages before disclosing the drilling work in an official news release. 'It's understandable that they'd put pictures up', Eleanor offered. 'They're proud of their work!'

Elsewhere in Vancouver, Mercantile staff members' enthusiasm was an object not of admiration, but ridicule. Days after the company released its 2013 field report, a rival executive whom I frequently met for lunch mocked the way he assumed the staff had anxiously prepared for the report's publication. 'Valuable shareholders need to be soft-sold with a little more mystery', he complained. 'Those guys [at Mercantile] spend so much time talking to investors about a news release before it even comes out that they drive down their stock price by eliminating the surprise!' As conversations I observed around the office made plain, however, Mercantile staff were well aware of the risks involved in over-burdening audiences with information. My first day in the office, I witnessed a senior staff member help a new hire disentangle these competing compulsions after an unsolicited phone call to a prospective investor went on for a few minutes too long. 'Try not to give people so much information over the phone', the senior staff member had gently admonished. 'You have to get them to *want* to ask more questions.' The same ethos extended to the online descriptions framing the weblinks to the company's technical reports. While the links were referenced ad-nauseum on Twitter and in mass emails immediately after every project announcement, the descriptions themselves rarely ranged more than two paragraphs in length. Typically offering only a few sample ore concentrations, they invariably concluded with a sentence or two of vague optimism followed by a paragraph-long disclaimer protecting the company against the implications of 'forward-looking statements'.

The variegated structure of Instrument-mandated technical disclosures has encouraged many exploration experts to engage with these literary technologies through a delimited and piecemeal approach. Particularly for 'serious' companies like Mercantile, formally regulated documents like preliminary economic assessments (PEA) can be made to function as vehicles for promotion, but only when referenced in brief and off-handed ways. Originally assembled at the height of REE market interest in 2011, the PEA for Mercantile's Nunavik prospect was the most comprehensive technical report on the project available to the public. Regularly re-submitted to the Canadian Securities Administrators and prominently displayed on Mercantile's website, the Nunavik PEA was updated after the publication of each new field report. For small-scale investors not invited to visit the online 'data room' that Eleanor maintained to allow prospective corporate partners access to Mercantile's data and geostatistical models, the two hundred-page-long document was their primary means of assessing the company's technical work. While few stockholders paid close attention to these data, Mercantile staff insisted, the *names* of the technical consultancies that Mercantile hired to audit its PEA and other reports were common reference points in conversations with potential investors. Some employees cataloged links between specific auditing firms and other REE exploration companies as an informal means of vetting their competition. Even if prospective

investors barely noticed Instrument-mandated documentary practices, in other words, exploration experts across the industry nevertheless followed their competitors' practices closely to see which companies were worthy of attention.

Promoters and geologists throughout Vancouver frequently mentioned shareholders' apparent inattention to detail while reflecting on the woes of the TSX-V. Even though rigorously checked technical data was more widely available than ever before, the rival executive insisted, 'people still want[ed] to buy some mystery'. 'Successful companies', he suggested, made their field reports public and keeping them up-to-date, but they also knew when to hold back. The first time I asked Mercantile's investor relations staff how many potential investors asked questions about the company's statistical models, everyone laughed out loud. 'About one … in a thousand!' one shouted from his cubicle across the room.

Jokes among Mercantile personnel underscored the cynicism and detachment that emerged as they navigated complex disclosure rules during everyday work. More darkly, however, these jokes also betrayed the degree to which junior staff members were developing the same categorical understanding of non-specialist investors imagined by the Instrument itself—an understanding sometimes colored by palpable disdain. Instrument-mandated reporting requirements, they insisted, were not aimed towards the 'serious investors' (who, according to Jack, 'rarely actually read the reports anyway'), but towards the same novices who had been drawn to Bre-X in such extraordinary numbers. Mercantile staff and the rival executive offered nearly identical portraits of 'serious investors' and the poorly educated non-specialists they imagined had been brought into high-risk exploration ventures trading through sensational news coverage, fantastic rumors, and the emergence of online investment tools. The rival executive was more explicit: 'These kinds of people hear about a few companies making money, and then they start thinking that penny stocks are a sure thing. They need to be told, over and over, that they might lose all of their money.' Reflecting on Mercantile's recent stagnation, he took on a foreboding tone. 'A stock trading at fifteen cents a share hasn't necessarily found its floor yet. It can always go lower. Always.'

Telling stories and showing work

The ways that exploration experts across Vancouver reflected on the impatience and skepticism they perceived among shareholders underscore how thoroughly experts' own fears of market collapse have come to inflect their everyday communication practices. That junior Mercantile staff were trained to see their performances of seriousness as rife with potential liabilities for the company, though, also stands in contrast with the ways technoscientific literary technologies are typically presented as securing knowledge and trust. The reports undergirding the gentlemanly sociality of early modern experimentalists, Shapin argues, functioned by convincing witnesses that they and the experimentalists who set experiments into motion had observed precisely the same details that the experimentalists had instructed them to notice (see also Goodwin, 1994; Law & Lynch, 1988). In order for exploration field reports and updates to Mercantile's PEA to secure the trust of potential investors, though, the authors of these documents had to learn to defer to the speculative musings of non-experts as well.

The effort that Mercantile staff expended in humoring investors' storytelling whims even as they carefully restrained many narrative urges of their own often caused conversations within the office to become saturated with weary humor. While I was working in the company's map room, I frequently heard investor relations specialists cackle as they perused new posts on the LinkedIn Rare Earth Elements group forum, typically after spending the morning on the phones. Shouting jokes from their desks, they mocked the more implausible posts that emerged every few days. During my first week on the forum, a technology news blogger enthusiastically posted rumors of nascent plans for sending automated REE-mining robots to the moon. Musings about robot-driven sea-bed exploration (already a lucrative mode of gold mining, but a far more tenuous scheme for mineralogically complex REE deposits; see Klinger, 2017), I soon discovered, surfaced every few weeks. By my second month in the office, I had seen enough of these posts to chuckle when a member laconically asked the forum, 'Is it that time of year where we talk about REE mining on the seabed again?'

Respected geologists and promoters, Eleanor and Jack often observed, understood the rules of the Instrument, but they also knew how to take jokes. The time I spent copy-editing field reports and press releases offered daily reminders that Mercantile staff could make only certain kinds of promises about the futures of their projects. The conversations we observed online, meanwhile, betrayed few inhibitions about discussing the future of specific prospects, REE-dependent technologies, or the mineral exploration industry as a whole. Group forum discussions provided a bridge between the formal genres of Instrument-regulated discourse and the informal domains where unconventional interpretations, rumors, and more general—and occasionally fanciful—aspects of REE knowledge could be articulated and shared. Discussions also provided a space of circulation for technical reports like the Nunavik PEA, and enabled prospectors, geologists, and novice investors to cite figures from these documents in a wide range of discursive registers. The boundary-breaking nature of many LinkedIn discussion threads, though, also laid bare the impossibility of dividing expert authors and non-specialist audiences into delimited roles, so that their ethics might be judged accordingly—a foundational premise of the Instrument. As forum discussion posts cited Instrument-generated documents and drew their numbers into far-ranging circuits of comparison, the authors of these documents continually found their status as moral agents thrown into confusion.

How exactly Mercantile staff members were meant to serve as trustworthy mediators within swift-moving forum discussions was a question that caused considerable anxiety for my interlocutors. While similar ambiguities affected countless exploration experts working within the post-Instrument regulatory environment, REE prospects posed additional challenges. Like other exploration financiers I met in Vancouver, Jack and many of Mercantile's staff had only recently begun working on REEs and other 'critical minerals' projects, after building careers with exploration companies focused on gold and other conventional commodities. The questions Jack faced during his first year as a Mercantile representative quickly persuaded him of the need for an informal venue for sharing information and making comparisons about emergent REE-based materials. Yet as he and others soon learned, simply 'explaining' the geotechnical reasons that some REE prospects were likely to be far more expensive to mine than others could expose

experts to unexpected legal liabilities. Skeptical investors, Mercantile staff often suggested, had to be made to feel that they were seeking out this information themselves.

For geologists and promoters attempting to convince skeptical investors of the accuracy and impressiveness of their exploration results, the sheer complexity of REE technology and mineralogy offered room for both confusion and arbitrage (see Beunza et al., 2006). Most investors, Eleanor explained, were accustomed to discussing other kinds of ore deposits simply in terms of their physical accessibility, 'grade' (i.e. the spatial distribution and concentration of the mineral of interest), and the overall project's projected yield. Faced with diverse mineralogical combinations bearing seventeen[3] target elements, each varying tremendously in concentration and market price, many early investors wildly over-estimated the likely value of poorly explored prospects. At Mercantile headquarters, the apparent disconnect between the stock prices and technical feasibility of competing REE projects was a common subject of complaints. Even as industry news coverage of the REE market spike began focusing on the radically different processing costs associated with different mineralogical settings, Mercantile staff observed, some companies with complex prospects (and thus extremely high mineral processing costs) continued to see their stock prices climb. Meanwhile, new funding for numerous more 'realistic' prospects (including the Nunavik project) had largely disappeared.

The ways that Mercantile personnel narrativized these divergences in private conversations with me highlighted how different kinds of experts directed traffic between disparate literary technologies. More subtly, though, they also betrayed senior geologists' abiding attachments to the technical descriptions and other conventional literary technologies that helped to secure their sense of disciplinary authority among themselves. While the young men who comprised Mercantile's investor relations staff often lapsed into cynicism while complaining about the dismal state of the company's stock price, senior staff members assured me that similar divergences between emergent projects' apparent feasibility and stock price routinely occurred whenever prices for idiosyncratic commodities rapidly rose and declined. 'Serious projects', Eleanor admitted, 'sometimes just get lost in the shuffle'. Like others I met in Vancouver, though, Eleanor and Jack insisted that the disorganized valuation of disparate REE prospects was at least partly related to prospective investors' lack of technical knowledge concerning REE mineralogy and materials—a lack that Eleanor explicitly correlated to investors' declining interest in the physical ephemera in Mercantile's map room.

By late 2011, Jack had begun soliciting geologists throughout the REE exploration community to offer technical 'tutorials' on the LinkedIn forum. Lesson topics ranged from the differences in technological applications for 'light' versus 'heavy' REEs, to wind turbine design, to narrative-style comparisons of the geographical surroundings of specific prospects. Jack often initiated tutorials himself and invited other forum participants to elaborate. Geologists and other experts working for universities, government research institutions, or other exploration companies often joined in, bridging their explanations with personal reflections and links to news articles.

The handful of Mercantile staff who contributed to these tutorials typically explained them as a means of lending legibility to the exploration reports and other technical documents displayed on the company's website. Providing 'basic technical literacy', they offered, was crucial to their efforts to train the gaze of wary investors onto

specific numbers within a company's PEA. Occasionally, a tutorial could direct new traffic to a PEA that had been lingering online for years. Rather than simply generating consensus about the technical merits of specific prospects by 'shutting off the flow of information' (Riles, 2010, p. 800) that overwhelmed many prospective investors, however, tutorials also enabled these people to move more easily between PEAs and other Instrument-focused documents and the free-form discussion that dominated the LinkedIn group threads.

In LinkedIn tutorials and elsewhere, the roles I observed geotechnical experts play in steering traffic between diverse literary technologies were subtle and indirect. Many of the geologists I met in Vancouver admitted to encouraging their audiences to engage with a broad range of exploration-related media in the hopes that these engagements would eventually 'help them to figure things out for themselves', in the words of one geologist. When I first asked Jack about his motivations for conscripting geologists to run the tutorials, he equated a prospector's idiom for an unexplored site with investor relations-ready narrative tools. 'A "blank slate" may wind up being a good prospect, but more developed prospects give you better stories to work with', he offered. Armed with a few simple tools of analysis, forum participants proposed provocative equivalences, free-associating between rumors of ore grades attached to superficially explored sites and the painstakingly audited estimates derived from projects years in the making. Yet by tacitly encouraging LinkedIn users to speculate about the possible futures of other REE projects, Jack's comments suggested, Mercantile staff were helping to ensure that investors would eventually return to 'serious' projects like their Nunavik prospect, once they had learned enough to be skeptical of other companies' boasts.

As Jack and Eleanor learned repeatedly, encouraging non-specialists to develop their own strategies of comparison could help prospective investors to develop long-term attachments to Mercantile, but it could also risk alienating them. Several years after I last visited Mercantile's Vancouver office, Jack shared with the group a brief, Mercantile-produced YouTube video depicting a new 'continuous HCl leach' ore processing technology then being developed at the company's prototype processing center. By December of that year, other group posts discussing acid leach-based processing technologies had begun linking back to the Mercantile video. A few posts also linked to other emergent prospects, proclaiming wildly impressive efficiency numbers for acid leach processes at these other sites without presenting any technical documentation. I emailed Jack to gather his thoughts on what I assumed were private companies (i.e. groups not trading on the TSX-V, and thus not beholden to Instrument-specified disclosure requirements) attempting to make their prospects look legitimate by association. 'This kind of thing happens all the time', he wrote back. 'Trying to fight it would only make it worse. Serious investors know bullshit when they see it.'

When I emailed other Mercantile staff for their reactions to the posts, they were less dismissive. 'We got a bunch of calls after those videos came out', one person admitted. 'At first we wanted to laugh, but it was good to have new people asking questions about the project again.' During my time at Mercantile headquarters, junior investor relations staff often admitted that they were wary about undermining, let alone mocking, their investors' more speculative questions, particularly during 'slow news' periods between releases of major exploration field reports. Parrying questions inspired by far-ranging industry gossip

as they deftly pointed prospective investors toward online references to Mercantile documents, they offered instead both the promise of steady work and the allure of a still-emerging technological space. Perhaps they understood more keenly than some of their colleagues the fragility of their mediating roles, with no technical credentials to take for granted. The contingent sense of authority evinced by junior staff members in their reflections, though, also seemed to free them to articulate a more open-ended sense of the company's possible futures. For a class of minerals where so much remained unknown, they often told me, any new development might boost the value of Mercantile's Nunavik prospect. Whether or not the company's shareholders would trust them enough to be patient for the project to unfold, though, both they and their senior colleagues were reluctant to guess.

Claiming crises

Efforts to regulate expert communications in venture capital markets have caused serious numbers and speculative narratives to circulate in linked and overlapping ways. Yet the radical divergence between the many literary technologies that occupy experts' day-to-day work—from staid and formally regulated documents like exploration field reports and preliminary economic assessments, to the unruly realm of LinkedIn discussions and YouTube comments—has done more than increase these experts' professional anxieties, or unsettle the prices of their companies' stocks. That individual experts remain legally responsible for eliding these contradictory pressures, and for keeping the moral economy of the disclosure system intact, underscores regulators' continuing refusal to acknowledge the dramatic risks and dark desires that keep venture capitalism in motion.

As a concept for relating social conventions to the production of knowledge, the literary technology offers tremendous insight into how scientists and other authors persuade audiences, and how they understand their work in ethical terms. But in domains where knowledge production is constrained both by elaborate procedural rules as well as by tactical play, authority and trust must be actively decoupled. The formulation of literary technologies still dominant in STS and related disciplines was developed for a relatively closed model of society, where the deployment of expert-approved communication conventions helped to enforce understandings of exclusivity specific to identifiable social groups, as well as more general concepts of class. As regulatory institutions like the Canadian Securities Administrators attempt to engineer trusting relationships by imposing literary conventions from without, however, the scale and boundedness of these influences must be reconsidered. Even as the traffic between 'serious' and 'speculative' literary technologies constantly displaces the authority of geotechnical experts, the interpretive agency that this traffic engenders also dissolves barriers for prospective investors, and keeps the possibility of membership in these communities permanently open. By facilitating the ongoing recruitment of small-scale investors into resource finance, such openness also extends the long-time goal of Canadian market markers by deepening public investments in settler colonial extractivism (see Pasternak & Dafnos, 2018).

The divergent and sometimes paradoxical roles that literary technologies play in everyday exploration finance underscores the challenge inherent in focusing market reform efforts on documents when the narrative practices, notions of authorship, and interpretive agency that these documents facilitate are being constantly reconfigured and rethought.

My conversations with mineral exploration experts in Vancouver strongly suggest that many of these people simply do not believe that collective faith in certified bodies of knowledge is possible, let alone sufficient to resolve collective crises.

Working among bankers and other financial experts, Riles observes a similarly pragmatic force effected through practices as mundane as filling out securities transfer receipts. 'An ethnographic approach to financial markets', Riles (2010, p. 806) insists, 'requires coming to terms with the market as a realm of explicit politics: of compulsion, of must, shall, and will, of purposeful government of self and others.' Bear (2020) finds equally consequential social processes emanating from mere acts of definition and differentiation—acts that exploration experts must perform continuously while engaging with prospective investors, perhaps dozens of times each day. 'To identify an activity as "speculation" has long been to take a moral position on economic reform' (Bear, 2020, p. 6). Yet as experts increasingly demur from criticizing investors' fantastical narratives even as they assume ever greater degrees of personal liability, the technical positions from which one might articulate new reforms are becoming more difficult to find.

Mineral exploration finance is increasingly shaped by gestures of deferral, from the legal liabilities and boundary work that regulators defer to individual experts, to the expectations of progress and profit that exploration experts ask shareholders to defer in turn. Together, these deferrals are undermining Canadian policymakers' efforts to present venture finance as a value-producing activity upon which other forms of commerce can depend. As Wood (2016, p. 53) observes, the technical analyses informing preliminary economic assessments and other 'regimes of reserve qualification', in addition fulfilling legalistic disclosure demands, 'also perform a form of resource management: one that rolls the future into the present in an urgent search for value creation, which unfolds as a rate of return.' Such a vision of management comports well with venture exchange boosters' efforts to present REE exploration finance as a domain of investment worthy of sustained government support (Stanley, 2016). Yet despite this support, the processes of search and return underlying the exploration industry keep failing, and mistrust in the industry's experts has only grown.

Throughout the months I spent visiting Mercantile's office, the 2013 field report for the Nunavik prospect failed to bring new investors to the company. Eleanor admitted that her own standing as a respected REE geologist, and Mercantile's standing within Vancouver as a 'serious' company, would not be enough to keep the project in operation if the TSX-V continued its general decline. As I write this article a decade later, the company remains open, but the relevance of Eleanor's forebodings have only grown. By 2016, the exchange index had fallen below 500 points, its lowest level since the Ventures Exchange was created in 1999. For another half decade, the index would remain below 1000; one third of its listed companies and nearly half of its total market value would eventually disappear as well (Market Intelligence Group, 2021). Particularly for junior personnel who began their careers after the introduction of the Instrument, the 'trust gap' bemoaned by senior colleagues is no longer an exceptional crisis, but rather a permanent backdrop for day-to-day work.

When I spoke with a promoter at a smaller REE-focused company in 2019, he cited the enervation of the entire TSX-V as justification for his reluctance to remain attached to individual projects. Companies focused on flipping, rather than substantially developing, new prospects, he explained, 'just need one good year in five, one mediocre year, and then

you can have three bad years and you're still way ahead'. That the previous decade had 'only brought one year of relief', he admitted, 'spell[ed] bad times for the industry'. For some Mercantile employees, the company's commitment to developing its Nunavik prospect to production compounded their anxieties by closing off escape routes. The jazz guitarist-turned-communications director, often Mercantile's loudest spokesperson at industry conferences, sometimes slipped into messianic tones while translating this near-term anxiety into long-term hope. 'The world needs our project to go into production', I once heard him shout during a phone call, 'and the venture exchange has to understand that!'

Perhaps the most important product of the exploration industry's traffic in literary technologies is not trust, then, but deferral itself. As they work to ameliorate the sense of crisis surrounding venture capital exchanges and convince shareholders to be patient as prospects develop, geologists and promoters have learned to encourage their audiences to ask questions that cannot be immediately answered: how large future markets for specific REE commodities might grow, or perhaps what kinds of processing techniques might emerge to make use of idiosyncratic mineral complexes whose ores are not yet economical to mine. Yet exploration experts' ambivalent engagement with diverse literary technologies also belies a far grander sense of potential influence. Certain deployments of numbers and narratives, Mercantile staff know, can also amplify specific senses of crisis—concerning the predictability of global mineral supply chains, for instance—in ways that might cast the mineral exploration industry as a whole in a different light.

Two years before I arrived in Vancouver, the CEO of Mercantile Minerals had bolstered the profile of the company's exploration work in Quebec by convincing American legislators to audit manufacturing supply chains for minerals sourced in certain countries like the Democratic Republic of the Congo. The resulting legislation, a section of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, helped to bring the term 'conflict minerals' into everyday use throughout North America (Wallstrom, 2011; see also Bell, 2023). In addition to casting the search for domestic REE sources as a national and moral imperative, the terminology also subtly obviated the sense of crisis pervading the TSX-V by conjuring future markets for REE ores. The geopolitical constraints that would produce these new markets would transcend periodic cycles of investor confidence and suspicion, industry officials suggested, and would eventually outlive any particular exchange.

Working amid a sense of perpetual crisis can cause experts to conceptualize their work primarily in terms of prohibited ideas and narrative avenues foreclosed (Roitman, 2014). Yet by subtly reframing attention their technical reports by tacitly encouraging speculative comparisons, Jack and other Mercantile staff have worked to present the crisis facing venture exchanges not as a blind spot, but as an aporia. 'A collapsing bubble can bring out great opportunities for the folks who stick around', Jack insisted as we left the office after a particularly long day. Speaking in an interview, John Kaiser, a well-known exploration industry blogger whose investment reports were widely read throughout Vancouver, offered a similar appraisal: 'The disappearance of 500 companies would be good for the sector. It would allow investors to focus on the serious companies' (Long, 2013). In the meantime, persuading investors to be patient would mean ceding space to other voices. Given enough time, the Instrument-generated paper trail would then eventually serve a new purpose: proving to skeptical investors that their trust had been warranted—and that the experts had been right all along.

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ORCID iD

Tom Özden-Schilling https://orcid.org/0000-0002-6809-0589

Notes

1. Mercantile Minerals, Jack, Eleanor, and the Nunavik project are all pseudonyms, as are names of other informants at Mercantile.
2. According to SEC Rule 506D, an 'accredited investor' must satisfy one of several qualifications pertaining to their overall wealth, market experience, and the scale of their investment (U.S. Securities and Exchange Commission, n.d.).
3. While many companies (including Mercantile Minerals) include niobium, tantalum within their discussions of rare earths, the group is formally defined as the fifteen lathanide elements, plus yttrium and scandium.

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Author biography

Tom Özden-Schilling is Presidential Young Professor in the Department of Sociology and Anthropology at the National University of Singapore, where he studies how legacies of labor deregulation are shaping emergent "critical minerals" research and development integration initiatives. His first book, *The Ends of Research: Settler and Indigenous Science in the Wake of the War in the Woods* examines fraught reproduction of settler and Indigenous environmental research groups in Canada.