



Review article

One concept fits it all? On the relationship between geoethics and responsible mining

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ABSTRACT

The increasing incorporation of ethical considerations and moral values into industry practices is a recent trend in mining governance, often included under the umbrella term ‘responsible mining’. The respective practices, norms and standards target corporations as ‘collective actors’. Within this paper we argue that this perspective falls short insofar as it disregards the different roles and positions of individual professionals in enacting ethics. This is due to the fact that the complex make-up of mining economies in terms of places, timeframes and social relations is not adequately considered in schemes for responsible mining. We approach the issue from two directions: First, we introduce the concept of geoethics that has been suggested as professional ethics in geosciences and related fields of work. Second, we confront it with the structural characteristics of the global mining sector by reviewing organizational features and the role of professionals in implementing ethics. Based on these reviews we argue that geoethics has the potential to complement dominant approaches of corporations as ethical actors by a focus on individuals. Yet it does so far not adequately deal with the different and sometimes competing responsibilities in the mining industry, notably (potential) tensions between individual and institutional responsibility.

1. Introduction

One of the latest trends in global mining governance is the increasing incorporation of ethical considerations and moral values into industry practices. Broadly speaking, the term *responsible mining* relates to changes in global mining practices and norms that have recently come to the fore. In an era of an “apparent ethical turn in corporate capitalism” (Dolan and Rajak, 2016, p. 3), corporations express a desire to engage in responsible mining. Today, they acknowledge that their operations not only create socioeconomic opportunities, but also have significant negative environmental and social long-term impacts for host nations, communities, and environments. Major companies are starting to “openly recognize certain duties to the societies in which they operate, beyond financial viability”, as Sarah Bice (2016, p. 8) highlights in her monograph entitled *Responsible Mining. Key principles for industry integrity*. While large-scale mining practices can hardly be environmentally sustainable in the pure sense of the concept (e.g. Kirsch, 2010; Gorman and Dzombak, 2018; Schneider et al., 2018), some argue that they still can be responsible (Goodland, 2012; Bice, 2016; IRMA, 2018; Schiapacasse et al., 2019). At times discredited as another buzzword of the

corporate world (Broad, 2014), responsible mining incorporates and represents an ever-increasing number of best practice standards in the mining sector (Hart and Coumans, 2013). Similar to CSR, there is no singular definition of responsible mining that includes all the policies and programs implemented in its name (see Blowfield and Frynas, 2005; Smith et al., 2017). It covers a broad spectrum of issues ranging from community relations, employment and industrial relations, and transparency in economic contributions, to environmental responsibility (Goodland, 2012; Wall et al., 2017). Responsible mining can thus be described as the expression of the CSR movement within the global mining economy, representing a contested field of discourses, practices, and institutional frameworks, still evolving, flexible, and overlapping, which is used by business to display itself as an ethical actor (Welker, 2014; see Dolan and Rajak, 2016; Smith et al., 2017). Similar to CSR, responsible mining has been criticized of narrowing power relations in that it privileges “the role of corporations in shaping the discourse around project planning” (Phadke, 2018, p. 170).

While earlier attempts to “moralize” the emerging system of corporate capitalism date back to the late 19th century, it was particularly in the past three decades that ethical schemes (e.g. CSR, the social license

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to operate - SLO, sustainable mining) to be implemented by corporations or the sector as a whole “flowered” around the globe (Carroll, 2004, p. 116; Jenkins, 2005, p. 526). This has not only broadened corporate areas of intervention (e.g. environmental protection, socioeconomic development, and labor rights) but also the groups to whom the firm is held accountable. These are not anymore only shareholders but workers, customers, suppliers, competitors, local populations or national and local governments (Sison, 2009; Dolan and Rajak, 2016). A number of advocacy initiatives evolved to reform the mining sector that extend beyond corporate self-regulation. ‘Responsible Mining’ has been promoted by corporations, governments, NGOs, and mining-impacted communities and has found expression in a countless number of certification schemes, guidelines, and sector-specific multi-stakeholder partnerships (e.g. Miranda et al., 2005; Hart and Coumans, 2013; Franken et al., 2020). They include the Global Reporting Initiative (1997), the Standards of the International Council on Mining and Metals (2003), and the Initiative for Responsible Mining Assurance (IRMA) (2006). Since most schemes are designed for and implemented by major companies and their producing mines, they often disregard the highly volatile Junior mining sector and important stages of the mining cycle, notably the exploration, permitting and planning, construction, and closing phases. Furthermore, many transnational policy regimes for responsible mining tend to (re)produce monolithic pictures of corporations as “black boxes” (Welker, 2014), powerful entities (Golub, 2014), and collective actors that are required to adopt “responsible corporate behavior” (Hart and Coumans, 2013, p. 2).

Recently there has also been discussion around the issue of individual responsibility in mining; notably professionals’ capacity to navigate different individual, professional and corporate codes of conduct (e.g. Di Capua et al., 2017; Smith et al., 2017). In the last decade the concept of *geoethics* was introduced as professional ethics in geosciences. Geosciences in the understanding of the geoethic proponents encompasses natural scientific and engineering disciplines to study the Earth system and related human-built systems (Bohle and Di Capua, 2019). Geoethics is unique in that it claims to address the ethical issues individual geoscientists (may) face in their everyday working environments, such as mining (e.g. Di Capua et al., 2017; Bohle and Di Capua, 2019).

In the paper at hand, we investigate different levels that ethics in mining addresses and how this might inform professionals as practitioners of responsible mining. The purpose is threefold: We will first discuss how geoethics adds an individual dimension to the concept of responsible mining, second discuss how corporations implement ethics in accordance with global industry practice, and third explore the role of geologists and engineers therein. In doing so, we aim to position the concept of geoethics more clearly within the rise of ethics in the global mining industry. We further point to the very structural challenges geoethics is confronted with in its attempt to mainstream ethics in geoscientific practice. Methodologically our paper is mainly based on a literature review to reveal how institutional ethics are shaped by a company’s position in the global mineral production network and how individual and collective actors (re)produce specific structures in mining industry. It also draws on some illustrative examples from one of the authors’ own empirical work on company-state-community relations in Burkina Faso between October 2016 and November 2018.¹ Due to the current lack of literature and research on the application of geoethics in the field of mining and the complex nature of the mining sector, we aim to show what geoethics (potentially) ‘contributes’ to these relationships.

¹ During a total of twelve months of multi-sited ethnographic field research interviews and conversations with politicians, residents and civil society actors were conducted mainly in the vicinity of two industrial mines (Houndé and Bagassi) in western Burkina Faso and in the capital Ouagadougou. The article is based in particular on participant observation at the mine sites and 98 interviews with various company employees (e.g. diamond drillers, managers, and CSR agents) and contractors.

The first part of the paper introduces the concept of geoethics and situates it within the wider CSR debate. It also analyzes the concept’s specific emphasis on sector professionals as agents of responsible behavior. In the second part, we confront the concept with the structural characteristics of the mining industry, namely the spatial and temporal complexities of mining economies and the positions of individual professionals therein. By examining the specific role geologists and engineers play within corporate structures and the mine life cycle, we reveal that existing ethical approaches fail to account for the tensions between personal and institutional responsibility. Taking into account the enactment of ethics by geoscientists, however, allows for a more nuanced picture of the competing responsibilities in the global minerals and metals sector.

2. Geoethics: the place of professional ethics within responsible mining

The more general rise of *ethics* in corporate capitalism (also known as the global CSR movement) has had multiple effects in the global mining industry which is one of the main employers for geoscientists. Instead of simply rejecting associated terms in global mining governance such as CSR, SLO or responsible mining as mere ‘green’ or ‘whitewashing’ of corporate behavior, social scientists have increasingly started to analyze how ethical practices, norms and standards shape and challenge (traditional) company-state-community relations. In their introductory chapter of *The Anthropology of Corporate Social Responsibility*, Dolan and Rajak (2016) identify two vantage points from which social scientists have explored the global CSR movement. First, the apparatus and architecture of CSR, and second, the local effects of CSR, its contestations, and responses to it. In doing so, they questioned CSR’s architects’ project of establishing a “supra-cultural ethic to govern disparate spaces and actors” (Dolan and Rajak, 2016, pp. 5–6) and challenged dominant assumptions of ethical industry standards which tend to address corporations as unified actors. Social scientists have increasingly analyzed ‘the black box’ multinational corporation and explored how in the extractive industries specific professionals and institutions co-constitute each other (Golub, 2014; Welker, 2014; Appel, 2019). Empirical studies have revealed, for instance, the different enactments of CSR in corporate boardrooms and at specific sites of extraction by individual mining professionals (Rajak, 2011; Welker, 2014; Sydow, 2016; Owen and Kemp, 2017).

While the scholarly debate recognizes the interplay and competition between individual and institutional responsibilities in corporate governance more generally (Swierstra and Jelsma, 2006; Trundle and Trnka, 2017), few studies have to date addressed these frictions in the global mining sector. They may occur between different scales of responsibility to which professionals in the extractive industries (are required to) adapt, i.e. those of professional values and individual agency on the one hand, and institutional norms and structural constraints on the other (Müftüoğlu et al., 2018). In mining contexts this may apply, for example, to responsibilities and obligations the individual professional has to the firm as an employer, to his colleagues, or to the people in the mining areas with whom he interacts. The few social scientists’ accounts that bring this topic to the forefront mostly refer to the role and position of CSR departments and their employees, and highlight different positionalities and hierarchies within mining corporations (see Kemp and Owen, 2013; Welker, 2014; Owen and Kemp, 2017). Marina Welker (2014) has shown, for example, how CSR agents’ task of “responsibilizing” a multinational corporation in Indonesia involves for them a constant struggle to acquire authority, resources and legitimacy within both company hierarchies and the communities with whom they interact.

These important works on competing responsibilities in the global mining sector, however, often only focus on a specific phase of the mining cycle (i.e. when resources are already being extracted) or do not sufficiently consider dynamics that connect the “upstream

mineralisation” (e.g. mining projects in the Global South) with the “downstream money” (Miskelly, 2004) (e.g. stock exchanges in the Global North) (e.g. Dougherty, 2013; Ayeh, 2021). Most importantly they downplay the role of people trained in geosciences within company structures even though their work informs responsible mining in significant ways (Li, 2011; Smith et al., 2017; Smith, 2019). Geoscientists working in the corporate world of metal mining enterprises² may be faced with inevitable conflicts between their own moral values, the professional values of their discipline, and the institutional imperatives of their employers (Herkert, 2001). Like other employees, they “play between the scales of personal responsibility and institutional responsibility” (Müftüoğlu et al., 2018, p. 265) in their everyday working environments. This is where the concept of geoethics comes into play. While ethical schemes such as CSR and responsible mining are mainly focused on corporations (collective actors), the concept of geoethics aims to deliver ethical guidance for the work of geoscientists as individual professionals and for the dilemmas they encounter. In the remainder of this chapter we show how mining is considered in geoethics and discuss the concept’s potential for adding an individual dimension to responsible mining schemes.

2.1. The concept of geoethics

Geoethics is conceptualized as professional ethics that addresses the responsibilities geoscientists have due to their specific knowledge and skills, and the potential environmental and social impacts of their day-to-day decision-making practices (Peppoloni and Di Capua, 2012; Bobrowsky et al., 2017). In its current understanding geoethics was introduced around 2009 by Italian geoscientists (Bobrowsky et al., 2017; Bohle and Di Capua, 2019). Since then geoethics has been taking shape as a field of research. A milestone in this regard was the foundation of the International Association for Promoting Geoethics (IAPG), an affiliated organization of the International Union of Geological Sciences (IUGS), in 2012. Its primary aims are the institutionalization of geoethics as a scientific discipline (Bobrowsky et al., 2017), and the establishment of strategic collaborations and partnerships to implement geoethical principles within universities and professional education. In both the association was quite successful as the growing numbers of publications and the integration of geoethical principles into the governance structures and policies of geoscientific professions via geoscientific associations around the world shows (Bohle and Di Capua, 2019; IAPG, 2020).

In spite of the increasing awareness for geoethics, the concept is not yet settled. What exactly it encompasses and on which themes it should focus, whom it addresses, and how it relates with and distinguishes itself from other ethical domains (e.g. environmental-, sustainability-, or engineering ethics), is an ongoing scientific debate (Bohle and Di Capua, 2019). Diverse interpretations exist about what type of ethics geoethics should be: deontological ethics (Martínez-Frías et al., 2011), virtue ethics, or amalgamed general and professional ethics.³ Furthermore, it still needs to be explored how ethical principles translate into operational toolkits in the diverse fields of application (see Bohle and Di

Capua, 2019). A consensus exists that geoethics refers to responsibilities of individual geoscientific professionals in fundamental and applied science as well as related engineering disciplines (e.g. Martínez-Frías et al., 2011; Bobrowsky et al., 2017; Bohle and Di Capua, 2019). Although Bohle and Di Capua (2019) and others explicitly address engineering disciplines as targeted field of geoethics in their publications, geoscience is the primary focus. Geoethics applies to geoscientific professionals working in diverse fields such as: the prediction of geohazards (natural risks) (e.g. Pascale et al., 2017); geoheritage, geoconservation and geotourism (e.g. Mansur et al., 2017; Moura et al., 2017; Gordon, 2018); geoeducation (e.g. Almeida and Vasconcelos, 2015; Pascale et al., 2017); geotechnical engineering (e.g. Basu et al., 2015; Meller et al., 2018); and the use of georesources, thus the mining sector (e.g. Limaye, 2015).

In these fields geoethics addresses “the entanglement of geoscientists’ roles and activities with those of other professionals and multiple overlapping non-specialist groups [...] and natural systems” (Boon, 2020, p. v). It aims to provide a framework of ethical principles, standards, and an operational toolkit for orienting and guiding individual geoscientists in their professional activities (e.g. Bohle and Di Capua, 2019). According to geoscientists’ specific skills, responsibility of the individual professional becomes significant in three different contexts: 1) responsibility towards the colleagues with whom the individual works and the geoscientific community (this is linked to good scientific practice), 2) towards society and cultural environments, and 3) towards the Earth system (natural environment) (Peppoloni and Di Capua, 2017; Bohle and Di Capua, 2019). These contexts reveal that the focus of geoethics is not limited to personal relationships and interactions but also encompasses larger issues relating to societal and environmental questions and dilemmas. These larger issues according to Bobrowsky et al. (2017) concern primarily: preserving Earth as a living space for all species and the conservation of geodiversity and biodiversity (including the sustainable use of georesources); helping society to manage natural or human-induced geohazards; ensuring society’s access to essential resources (e.g. mineral resources); teaching and educating others about the importance of geoscience and its related topics.

The ideal geoscientist in the current geoethical conception is an informed steward of the Earth who helps to respect the limits of ecosystems (the degree to which they can be disturbed), advocates for society, and serves societal interests (Martínez-Frías et al., 2011; Bobrowsky et al., 2017). This should be done for example by counseling decision-makers, providing geoscientific knowledge, and educating people (Bobrowsky et al., 2017). Principles that are defined for geoethics include honesty and integrity (e.g. following principles of good scientific practice), transparency (e.g. disclosing conflicts of interest, informing others about natural hazards), reflexivity (e.g. reflecting on the potentials and limitations of one’s own actions), reliability (e.g. distinguishing facts from interpretations) (Bobrowsky et al., 2017; Bohle and Di Capua, 2019), and a collaborative attitude that respects the values and ideas of others (Bobrowsky et al., 2017). Furthermore, principles of good scientific practice should apply in everyday working environments (Bobrowsky et al., 2017; Gundersen, 2017). In the following section we will reveal how geoethics addresses challenges geoscientific professionals are faced to in the field of mining.

2.2. Enacting geoethics in the mining sector: opportunities and challenges

Resource use and mining is considered to be a field in which geoethics applies. The importance of mining as a field of applied geoethics seems to be underlined by the fact that a five-page *White Paper on Responsible Mining* was published by the International Association for Promoting Geoethics (IAPG) in 2017 (Arvanitidis et al., 2017). The paper has been developed based on a review of literature the authors deemed relevant for the issue, stemming from diverse scientific disciplines and publications of organizations and initiatives in the field of (responsible) mining. The White Paper focuses on industrial mining and

² Geoscientific professionals in the mineral and metals sector work for a variety of institutions such as corporations, universities and research centres, or government agencies. Within this article, we focus our analysis on geoscientists working in the corporate world.

³ Existing geoethical literature is neither explicit nor precise about what different ethical conceptions mean for geoethics. Thus, more recently, the concept has been framed as “enriched geo-professional virtue ethics” that aims to contribute towards a cultural shift in society that advocates for more responsible interaction with the Earth system” Bohle and Di Capua (2019, p. 5). This understanding seems to depart from the idea of pure professional ethics e.g. Bobrowsky et al. (2017); Limaye (2015); Vasconcelos et al. (2016). The significance of this new trend and the underlying ethical conceptions of geoethics require further analysis which we cannot deliver in this paper.

follows an understanding of ethics that has been promoted by the mining industry and its various multi-stakeholder partnerships.⁴ The authors list a broad variety of issues they consider as best practices of and applicable guidelines for responsible mining along a mine's lifecycle from exploration to closure and rehabilitation. The topics include: establishment of good relationships with local communities throughout the mining cycle including open and continuing dialog; ensuring good governance and tackling bribery and corruption; avoiding land use conflicts; healthy and work safety for employers as well as issues related to diversity and gender equality; management and mitigation of environmental risks and minimization of impacts; organizing safe and efficient waste management; increasing biodiversity; fostering the use of renewable energies and considering mining waste as a resource (Arvanitidis et al., 2017). The White Paper claims in a very general manner that geoscientists and (mining) engineers have a responsibility concerning these issues: "It is necessary to deal with these challenges in a responsible way. This also means that geoscientists and engineers will need to build their capacity and skills" (Arvanitidis et al., 2017, p. 1). However, the White Paper explicitly leaves the scope of a professional ethics by claiming that it aims to draw the attention of geoscientists, companies, policy-makers and societies to responsible mining (Arvanitidis et al., 2017, p. 2). In doing so, it states for example that "companies may have to deal with circumstances that could pose ethical challenges" (Arvanitidis et al., 2017, p. 1). Thus, the paper blurs who ought to be responsible to deal with the issues it highlights – institutional actors (e.g. corporations or governments), or individual professionals (e.g. geoscientists or engineers) – and how these competing responsibilities should become enacted.

Apart from the White Paper only a few geoethical publications explicitly touch upon the enactment of geoethics by individual professionals in the context of resource extraction. Shrikant Daji Limaye (2012) considers that the tasks of geoscientists related to mining and the use of natural resources are first, to educate civil society about eco-friendly uses of natural resources and second, to contribute to mining-related decision-making. Geoscientists shall ensure the transparency of processes, involve all stakeholders (such as communities and government representatives), and act in an eco-friendly way. Geoethical behavior shall be directed towards societies adjacent to mining projects. It considers compensation for mining-related losses suffered by local communities. This applies, for instance, to the provision of youth education, job opportunities for the elderly, health services and other infrastructures (Limaye, 2012, p. 380). Bobrowsky et al. (2017) emphasize that geoethical thinking should be subject to critical analysis on the use and management of geo-resources, including mineral resources, in order to ensure societies' access to them. According to these authors geoscientists and geoenvironmental engineers should seek to develop a comprehensive picture of the potential impacts of mining activities by conducting analyses using multiple approaches as well as a variety of knowledge, skills, and experiences in order to propose multi-disciplinary solutions (Bobrowsky et al., 2017). Peppoloni et al. (2019) see the duty of geoscientists in identifying and revealing contradictions and ambiguities together with stakeholders and communities. Geoscientists shall use geoscientific knowledge to frame problems such as the increasing demand of mineral resources for renewable energies mined insofar "untouched areas", or human rights abuses in the context of conflict minerals, and inform decision-making (Peppoloni et al., 2019). Thereby, as Bohle and Preiser (2019) highlight, non-scientific local knowledge and experience should also be incorporated into geoscientific practice.

So far only few authors have addressed the various ethical challenges

and decision-making dilemmas that may occur when upholding ethical principles in a professional field that involves geological commodities. As a central problem Bobrowsky et al. (2017) identify the limited freedom of choice individual professionals have, due to the dominant market and profit-orientation of mining corporations. Bobrowsky et al. (2017) and Gundersen (2017) provide experiences from the field in this regard and reveal various ethical challenges: these may concern relationships geoscientists have with their colleagues and the geoscientific community, the companies they work for, their host communities and national institutions, the broader society or the environment. One of these challenges are tensions between professional and institutional responsibility. Tensions may occur due to the fact that geosciences often appeal to people and students with strong ideals regarding nature, the Earth, and the contribution they might deliver to solve global problems (Bobrowsky et al., 2017; Smith, 2019). Individual motivations and ideals can easily conflict with codes of conduct, objectives and goals that emerge from dominant corporate practices that limit the individual's agency (Bobrowsky et al., 2017).

The concept of geoethics could deliver guidance for various dilemmas individual geoscientific professionals may encounter in the context of mining (Bobrowsky et al., 2017). However, crucial ethical challenges, tensions, or dilemmas resulting from the specific structural constraints individual geoscientists (and engineers with geoscientific background) may face in mining contexts, are so far not dealt with systematically in mining-related geoethics literature. For instance, the aim of conducting "open, inclusive, and continuing dialog with local communities throughout the mining cycle" (Arvanitidis et al., 2017, p. 2) may be constrained by the fact that exploration teams and geoscientists are usually poorly equipped in terms of CSR, and have little or no expertise in stakeholder engagement processes. Furthermore, the conceptual link between professional ethics ('geoethics') and ethical schemes in the field that address corporate actors (responsible mining, CSR, or SLO) has not yet been sufficiently explored. The same applies to geoethics' relationship to engineering ethics.

In order to better understand geoethics' role in addressing responsibility for geoscientists and engineers in the mining sector, the next section will highlight dominant structural characteristics of the global mining industry and how they are constituted by specific places, time-frames and social relations. This will be done by first, reviewing how different types of companies as employers of geoscientists address and implement institutional ethics and responsibility and, second, by highlighting the tensions that may arise for individual geoscientific professionals in the different stages of the mining cycle.

3. Structural characteristics of the global mining industry and the role of geoscientists

To illuminate the individual agency of specific mining professionals and structural constraints, as well as how this folds back on competing responsibilities for implementing ethics, we need to unpack the 'black box' multinational corporation (see Welker 2014, Müftüoğlu et al., 2018). This also applies to the make-up of the global mining economy more generally, and the various spatio-temporal dimensions and actors involved. Resource extraction is occurring in increasingly diversified areas and contexts around the globe in order to satisfy global demands for minerals and metals, and to counter the depletion of more accessible resources (Barham, 1994; Sidorenko et al., 2020). In response the mining industry has massively increased its exploration budget (Everett and Gilboy, 2003; Dougherty, 2013) and directed it to ever more peripheral world regions since the 1980s and notably in the 1990s (Bridge, 2004b; Geenen and Verbrugge, 2020). The new global demand for high-tech metals and rare-earth elements (e.g. for use in the context of the energy transition and the transport sector) may also lead to a spatial redirection of investments to traditional mining regions, such as those in Western and Central Europe, as well as a reevaluation of those regions (McLellan, 2020; Sidorenko et al., 2020). The geographical dispersion of

⁴ The issue of artisanal and small-scale mining (ASM) is mentioned. Responsible mining activities in this regard would entail: training, access to technology, and enhancing resource governance in respective countries Arvanitidis et al. (2017). Other authors in the field allude that artisanal mining has not yet been addressed in geoethics Bohle and Preiser (2019).

mining projects around the globe and the related organizational structures of the mining industry, however, are not unique to the 21st century mining economy. Since the 19th century, the global mining industry has been characterized by large business structures and the increasing spatio-temporal complexity of industrial mining projects (Armstrong et al., 2014). Today this complexity involves different types of companies, different stages of the mining cycle, as well as interactions between mining professionals (e.g. geoscientists, CSR officers, engineers) and various stakeholders in the home and host countries of the mining industry (Thomson and MacDonald, 2001).

So far, social science research on mining has seldom provided an analytical and empirical examination of the complex organizational structure of the mining industry, differentiation between companies in terms of size and capitalization, and the division of labor within the industry in relation to the mining cycle. Although some scholars address industry structures, they neither relate these structural characteristics to the role played by individual professionals, nor do they reveal the impact these structures have on responsible mining practices (Thomson and MacDonald, 2001; Everett and Gilboy, 2003; Dougherty, 2013, 2016; Sidorenko et al., 2020). In this section, we explore how the structural characteristics of the mining industry shape the implementation of ethical guidelines by different corporate forms, and responsibilities geoscientists are faced with along the mining cycle. In order to do so, we combine findings from the literature with findings from our own empirical research on gold mining projects in western Burkina Faso.

3.1. Different types of companies and varying commitments to ethics: Juniors, mid-tiers, majors

This section focuses on how institutional ethics are shaped by a company's position in the global mineral production network (Dicken, 2015; Geenen, 2018). This refers in particular to the company's size, its financing schemes and stock market listing, as the legal situations in the home and host countries. The global mining economy is dominated by public companies listed on stock exchanges in Canada, Australia, the United Kingdom, and the United States (Thomson and MacDonald, 2001).⁵ In contrast to the oil and gas sector, where many big players are state-owned companies, the mineral and metals sector mainly comprises of privately held international corporations (Dicken, 2015; NRGI, 2015; Müftüoğlu et al., 2018). They operate in different world regions and can be differentiated according to their roles in the mineral production network. While the global mining sector is shaped by constant and rapid mergers and acquisitions of firms (Everett and Gilboy, 2003; Dougherty, 2016), the latter typically have different interests, practices and capacities to implement responsible mining. Since "no corporate actor exists independent of its ongoing enactments" (Welker 2014, 35), these are to different degrees co-produced by their employees. Individuals such as the chief executive officer (CEO) or the members of the board of directors may be particularly involved in the decision-making whether their company commits itself to institutional ethics or not (Thomson and MacDonald, 2001; Bray, 2013). Analyzing characteristics of mining companies in more detail allows us to situate the capabilities and capacities of individual professionals (i.e. of geoscientists) to implement responsible mining in areas of mineral exploration and extraction.

Existing scholarship on the structural characteristics of the global mining economy identifies three types of mining companies that have dominated the metals and minerals industry in the past 40 years: major (or senior), mid-tier (or intermediate), and Junior firms (Everett and Gilboy, 2003; Dougherty, 2013, 2016). This vertically integrated model

was originally applied to Vancouver-based mining firms but today it is used globally (Thomson and MacDonald, 2001). A distinction according to size (number of employees and number of sites), market capitalization (the market level of a company's equity), and sources of revenue (equity financing, production and/or sales) appears in academic work and is used by industry representatives, such as companies, investors, and consultants (e.g. NRGI, 2015; Investopedia, 2019; Beattie, 2020). In the following section we show how these categories are not always fixed or clearly defined, but instead ambiguous, fluid and relative (Dougherty, 2013). Nevertheless, the financial and human resources, and the degree of institutionalization of ethics within companies, may have an impact on company-community relationships.

(1) Major firms represent the largest and most widely known companies such as Anglo American or Rio Tinto. They usually possess many production sites in multiple world regions, and derive their revenue from production and sales (Thomson and MacDonald, 2001; Dougherty, 2013, 2016). They are organized in hierarchical structures spanning from corporate head offices to sites of production, and they usually feature subsidiary companies that develop, construct and operate single mines in areas of extraction. Subdivisions or departments of these companies are often in charge of carrying out specific tasks, such as geological investigations, operations, security, community relations, or sustainable development (Rajak, 2011; Welker, 2014; Ayeh, 2021). A highly specialized workforce is hired to fulfill these tasks, e.g. geologists in departments concerned with mine surveillance and exploration of the reserves, and engineers in departments related to infrastructure building, production, or machinery service. Some engineering tasks, such as drilling and underground operations are often outsourced to contractors and implemented by their workforces (Rubbers, 2019; Ayeh, 2020). Multinational mining corporations rely on outsourcing and leasing practices – not only for their heavy equipment (Dicken, 2015; Tauber et al., 2018), but also for obtaining community consent for their operations. In their efforts to acquire extraction licenses, they often subcontract consultancy firms to carry out temporary tasks such as social and environmental assessments (Dougherty, 2019; Ayeh, 2021).

To date, responsible mining schemes have primarily concerned and targeted major mining companies (Everett and Gilboy, 2003; Bray, 2013; NRGI, 2015). There are several reasons for this. Firstly, major companies have a reputation to lose and therefore adhere to and implement best practice industry standards, such as the IRMA standard for responsible mining or that of the International Council on Mining and Minerals (ICMM). Some of the leading multi-stakeholder partnerships in the field are composed only or mostly of major mining companies (Armstrong et al., 2014; NRGI, 2015). According to John Bray (2003, p. 294), reputational risks constitute "the most significant political risks since the 1990s" for multinationals and are thus countered by corporate risk management (e.g. Welker, 2009; Kirsch, 2010). In an era of the "ethical turn in corporate capitalism" (Dolan and Rajak, 2016, p. 3), companies that act in socially and environmentally responsible manner are less likely to face reputational damage on local, national, and international scales. Internationally, major companies (and their investors and shareholders) are confronted with public campaigns organized by civil society groups and NGOs much more frequently than smaller companies. This is due to the fact that they are well known and highly visible actors in the field (Basedau, 2005; Luning, 2012a). Also, the large number of mining projects they operate increases both the likelihood that some of their projects will cause local grievances and the human and financial resources necessary for the implementation of responsible mining. Highly specialized subdivisions such as CSR and sustainability departments in corporate head offices and at sites of production are in charge of monitoring company-community relations and implementing environmental and social standards on a daily basis. And thirdly, majors are usually more committed to responsible mining due to their relatively long presence in one mining region (up to 100 years for an operating mine). Given that major mining companies involved in exploration endeavors are likely to inherit the sites they are

⁵ Although Artisanal and Small-Scale Mining (ASM) represents another important segment of the global mining economy, our focus within this paper lies on multinational corporations, i.e. the industrial sector where geoscientists usually work.

exploring (Dougherty, 2013), and often have operating mines in the direct vicinity of their exploration projects, they may have a specific interest in long-term, peaceful coexistence with the local populations.

(2) Mid-tier firms operate a few sites that are usually located in one world region. Besides their regional focus (e.g. West Africa), they usually specialize in the extraction of one particular mineral (e.g. gold). They often start out as expansionary Juniors and evolve to become intermediaries in the form of producers, by extracting the deposits they discovered on their own. Similar to majors, they derive their revenue from production and sales, and the focus of their work is on ramping up production after Juniors have done the exploratory work (Everett and Gilboy, 2003). With specialized (sub)contractors, departments and trained staff (e.g. engineers, geologists, CSR officers), their organizational make-up bears significant resemblance to that of the major companies. Mid-tiers, however, must often raise equity for major acquisitions and mine construction (Thomson and MacDonald, 2001). With fewer operating mines, they have less access to capital and a smaller budget than majors which, in turn, also affects their responsible mining policies. By professionals working in existing CSR and environment departments at extraction sites, this is cited as a reason why extensive financial and human resources to implement ethical standards are non-existent (Ayeh, 2021). Beyond these perceptions of lacking capital for CSR, the temporality of such companies' mining projects and reputations are equally important factors with regard to the capacity of their employees to implement responsible mining practices. Mid-tiers are subject to mergers and acquisitions more often than majors, and are thus a waning presence in areas of extraction. While many of the multi-stakeholder partnerships or lender requirements for responsible mining (e.g. those of the International Finance Corporation) may also apply to mid-tiers (Ayeh, 2021), they face fewer reputational risks than well-known multinationals.

(3) Junior companies are the smallest units among multinational corporations and are mostly devoted to exploration, although expansionary Juniors are sometimes involved in extractive activities. The label "Junior companies" is strongly related to the world of financial markets and investments, where it serves as a "classification for all small mining companies that are most affected by mineral price fluctuations, and which represent the financially volatile and high-risk portion of the industry" (Hilson and Murck, 2001, p. 411). This category is essentially made up of venture capital companies, as Juniors rely almost entirely on the capital market to finance their activities (Thomson and MacDonald, 2001; Dougherty, 2013; NRG, 2015, 2016). Therefore, they serve and are dependent on a finance audience that is eager to invest in firms with relatively little capital, short histories but high hopes for huge returns (Beattie, 2020). The Toronto venture exchange (TSXV) and the London-based Alternative Investment Market (AIM) are specialized stock exchanges that bring together such investors and emerging companies seeking capital for their activities. The Junior mining sector's bad reputation, which was reinforced by major scandals in the 1990s, has caused the sector to become more sensitive to ethical questions over the past 20 years. Changing investor attitudes, new ethical norms in the sector (e.g. the TSXV rules for resource classification, established in 2000), and the potential difficulties faced by Junior companies when they want to sell to majors all imply an increasing consideration of social and environmental issues (Dougherty, 2013; Kneas, 2016; Boon, 2020). In that regard, the International Finance Corporation published in 2014 "a good practice handbook" for "early stakeholder engagement" specifically addressing Junior companies in the extractive industries (ICF, 2014).

However, Junior companies continue to be faced with specific ethical challenges due to their focus on "greenfield" sites (places with little or no prior history of mineral extraction) (Kneas, 2016). For instance, these challenges can arise when they enter areas that have suffered from political violence, have a weak mining legislation, or a record of human rights violations and corruption (Bray 2013). Also, the companies' capacity for implementing responsible mining practices is

limited due to financial, temporal, and reputational reasons. First, Junior firms focus on their core activities (that is geosciences) for financial and organizational reasons (Everett and Gilboy, 2003). Due to their financial constitution, Juniors have scarce resources, are thus "in a hurry to make quick returns" (Bray, 2013, p. 301), and tend to underperform in social and environmental aspects. They bundle geoscientific expertise such as geology, geophysics, mineralogy, or modeling but their small teams often have neither the expertise nor the infrastructure and equipment to implement responsible mining. If CSR or community relations are part of their corporate policies at all, their articulation has been described as "impulsive, misplaced, and rather amateurish" (Kneas, 2016, p. 80). Second, the success or failure of Juniors often depends on one particular project, and exploration licenses are often sold as quickly as they have been acquired. The classic approach of a Junior is to explore deposits, develop them by adding new information until their financial viability is proven, and then sell promising licenses to mid-tiers or majors (Bray, 2013; Dougherty, 2013; NRG, 2015; Gilbert, 2020). Dougherty (2013, p. 344) assumes that the knowledge that major firms will inherit the site and potential conflicts is another reason for "the social and environmental underperformance of junior companies". Third, as rather "precarious entities" (Kneas, 2016, p. 70), they are under less public scrutiny and are usually not required to adapt to most of the international guidelines for responsible mining. They are often not members of the respective multi-stakeholder partnerships (such as the ICMM), because these only address the largest companies or later stages of mining (NRG, 2015).

The global mineral and metals industry is characterized by a complex network of different-sized companies (majors, mid-tiers, Juniors), and their supplying industries. They are related by a typical division of labor, wherein majors and mid-tiers often rely on the Junior sector for their discoveries and take over projects or acquire entire companies. This can be nicely illustrated by Burkina Faso's gold mining sector, which may serve as a typical example of the current structural characteristics of the global mining industry. However, it also exemplifies that varying commitments to ethics not only depend on different-sized firms, but also how they are organized internally and the respective tasks, agency and goals of individual employees. For decades, risk-taking Junior companies have been entering Burkina Faso: a country that represented a sort of 'greenfield territory' to invest in, with known mineral reserves and an extremely investor-friendly mining legislation (Luning, 2012a; Ayeh, 2021). Since the 1990s, a significant number of international Juniors have held exploration concessions in the country. With the gold price reaching new records from 2011 onwards, Junior companies started to invest in the development of their assets, and many of them sold their promising concessions to a number of multinational mid-tier companies that specialized in extracting gold from the Birimian Greenstone Belt in West Africa. In mid-2020, Canadian, British, or Russian-based firms operated 16 gold mines in Burkina Faso located all across the country (MMC, 2020). One of them is the London-based company Endeavour Mining, which originally acquired promising exploration concessions in Burkina Faso from two Canadian Juniors, Avion Gold (in 2012) and True Gold Mining (in 2016) (EDV, 2012, 2016), and later developed them into operating mines. With the acquisition of its smaller rival Semafo in July 2020, the company recently became "West Africa's top gold producer" (Jamasmie, 2020). In its self-portrayal, the company emphasizes its commitment "to principles of responsible mining" (EDV, 2020). It runs CSR departments at all four operating mine sites and publishes annual sustainability reports. The company's responsible mining policies do not, however, directly address its multiple exploration and development activities. In the western province of Tuiy alone, Endeavour Mining (via its Burkina Faso registered subsidiaries) owns mining licenses covering a land package of more than 1000 square kilometers. Most of them are exploration concessions held by subsidiaries with specialized exploration and construction teams. Interviews with employees of one of the company's production sites have revealed that CSR teams are not formally in charge

of the exploration activities of these subsidiaries and they don't see themselves as responsible for the exploration projects of the parent company - even if the exploration projects are located in the direct vicinity of Endeavour-owned operating mines. While some of the more developed exploration projects may have a person in their team who is responsible for community affairs, many exploration projects are implemented and monitored by a handful geoscientists and engineers (e.g. for drilling) who are the first to represent the company in a given local setting (see [Luning, 2012b](#)).

The example reveals how in areas of extraction the current division of labor between different-sized companies tends to outsource "the bulk of the industry's 'dirty work'" ([Dougherty, 2016](#), p. 89) to poorly equipped Junior companies, exploration teams and consultancies during the first phases of the mining cycle. Institutional ethics and related terms (CSR, SLO or responsible mining) of mid-tier or major companies might not apply in this case. In his monograph *Relationships and the course of social events during mineral exploration*, Jan [Boon \(2020, p. 2\)](#) emphasizes that the adjective "corporate" in the term "corporate responsibility" may sometimes be "misleading as it draws attention away from the fact that all actors involved need to be socially responsible". Corporate responsibility is, after all, enacted by different individuals who represent the corporate form throughout the mining cycle ([Golub, 2014](#); [Welker, 2014](#)). The next section will highlight the particular role of geoscientists therein.

3.2. Geoscientific responsibilities in different stages of the mining cycle: exploration, development, operations, (post-)closure

The global mineral production network is largely characterized by different temporalities of extraction. This not only applies to the actual and imagined temporality of mining landscapes but also to extraction's specific timeframes and cycles ([D'Angelo and Pijpers, 2018](#)). As we will reveal in what follows, different ethical issues are relevant at different stages of the mining cycle, i.e. exploration, development (planning, permitting and construction), operations and (post-)closure ([Bridge, 2004a](#); [Bray, 2013](#); [NRGI, 2015](#)). While some companies are only involved in one of the stages (e.g. Juniors active in the discovery of mineral deposits), mid-tier and major companies are usually involved in all phases of the mining cycle. Yet even if the parent company is involved in everything from exploration to (post-)closure, the ethical legacies of its projects are shaped by different subsidiary companies, teams, and individuals ([Ayeh, 2021](#)). In this section, we aim to reveal the (potential) responsibilities and challenges that geoscientific professionals are confronted with in the different phases of the mining cycle. We thereby indicate different tasks of the professional groups, addressed by the geothics concept: geoscientists or engineers with a geoscientific background.

(1) The exploration phase of a mining project includes several sub-stages that involve different technological procedures and staff. An assessment of whether exploration is worth considering is usually based on a desktop review of all publicly available geological information, followed by airborne geophysics, sampling, soil and surface rock analysis, or geological mapping. These tasks most importantly involve geoscientists such as geologists, geophysicists, geochemists, mineralogists, or geomorphologists. Engineers are for example engaged in drilling operations (often outsourced to a contract drilling company) ([Dicken, 2015](#)). Yet, the mere existence of mineral deposits far from guarantees a site's commercial viability, nor does it automatically lead to a mining project ([Bray, 2013](#); [Davidov, 2014](#); [Richardson and Weszkalnys, 2014](#)). [Boon \(2020, p. 1\)](#) emphasizes that "only a low proportion of exploration projects ever become a mine and the high financial risk involved at most stages creates considerable uncertainty". The period from early exploration to the first mining of minerals is not only cost-intensive, it also implies significant timeframes. For example in African contexts, it typically takes 10 years for a mining project to proceed from the initial exploration to full-scale operations ([Bray 2003, p. 290](#)).

This temporal dimension and the uncertainty during exploration has significant effects on company-community relations and the enactments of corporate responsibility. The exploration phase of mining projects involves a variety of actors that are not permanently present in mining areas. Empirical evidence from Burkina Faso suggests that an exploration license usually changes hands multiple times between different Junior companies before a mid-tier company acquires the concession and decides to develop it into an operating mine. This often involves different individuals (e.g. geoscientists, drilling engineers and CSR agents) enacting the corporation's responsibilities towards neighboring populations ([Luning, 2012a, 2012b](#); [Ayeh, 2021](#)). Exploration teams are only sporadically present in areas covered by their licenses. This is due to the nature of their activities, the unpredictability surrounding whether projects will actually result in production, and, at times, the (lack of) legal requirements. The periodic presence and absence of company staff in mining areas during this phase can best be described as a "patchwork geography of [...] on the ground presence" or even "surface absence" ([Kneas, 2016, 68; 80](#)). Once an exploration license is obtained from administrative services in the host country, exploration often continues to involve few if any onsite staff from the exploration company in the concessionary space. Surveys from the air, for instance, provide important information about geological formations before a company decides to drill any holes or conduct seismic testing in the concessionary area ([Bray, 2013](#); [NRGI, 2015](#)).

A range of other structural factors may encourage what [Boon \(2020, p. 7\)](#) by mining professionals during exploration. As discussed in the previous section, these are for instance limited financial, temporal and human resources companies may provide to their employees for tasks beyond their profession ([Everett and Gilboy, 2003](#); [Bebbington, 2010](#); [Bray, 2013](#)). Therefore, in the exploration phase of mining projects, the "prime concern is with geology rather than politics" ([Bray, 2013, p. 310](#)). Individual professionals are typically focused on their day-to-day geoscientific and engineering work (e.g. drilling) and are "ill-equipped" to fulfill all non-technical tasks ([Everett and Gilboy, 2003](#)). The early prospecting phase involves large prospecting areas and very small field teams made up primarily of geoscientists. The latter often perform many roles including team leader, chief geologist and main contact person for managing the expectations of stakeholders ([ICF, 2014](#)). In *Alidou, l'Orpailleur* ([Delisle, 2002](#)) the geologist and children's book author Paul-Claude Delisle describes the everyday socio-cultural encounters between the Canadian geologist Vincent and his Burkinabè assistant Alidou, a former artisanal miner. Delisle who has been an exploration geologist for Endeavour Mining projects himself, describes how one of the main challenges Vincent and his team are facing stem from local and national intermediaries whom they rely on for their operations. In the absence of a legal framework for compensation provided by host legislations, for instance, exploration geoscientists have to negotiate with land owners and users to secure access to the land and resources covered by their exploration concessions ([Ayeh, 2021](#)). As "first comers" and principal negotiators in these settings ([Bebbington, 2010](#); [Luning, 2012b](#); [Kneas, 2016](#)), the geoscientific staff from mining companies who are present during exploration shape the ethical legacies of mining projects in significant ways ([Li 2015](#); [Smith 2017](#)). Social conflicts arising during this phase usually affect most of the company-community relations in the later stages of the mining cycle. Geoscientists aiming to understand and, where necessary, address these challenges thus set the groundwork for the future (commercial and social) success of mining projects ([Bray, 2013](#); [Boon, 2020](#)).

(2) The development phase (late exploration, planning and permitting, construction) is decisive for the technical and financial, but also the social and environmental feasibility of mining projects. This phase essentially consists of two sub-stages: the planning and permitting process, and the construction of the mine site. Prior to this a series of feasibility studies is prepared on the basis of the project's geological prospects, commercial viability, and a range of other factors (e.g. the

political and infrastructural environment). Companies use the studies to decide whether to commit themselves to a project or not, and negotiations with potential investors are carried out (Bray, 2013; NRG, 2015). Company-community relations are critical in that they ensure a mining project's longevity. "[...] mistakes made at this point may never be repaired" (Bray 2003, p. 312), and according to ethical norms in the mining industry, a project should gain the prior and informed consent of the people who will be most affected before going into production. To this end, many jurisdictions around the globe now require Environmental and Social Impact Assessments (ESIAs) and (if necessary) Resettlement Action Plans (RAPs) to be undertaken before authorization for certain types of projects is granted. Since the early 2000s legally sanctioned impact assessments and international standards for Mining-Induced Displacement and Resettlement (MIDR) are increasingly required by investors, lenders and insurers (e.g. the World Bank Group), and have thus become an essential part of the planning process (Price, 2009; Owen and Kemp, 2015). Mining engineers can be considered key actors in this phase since they have to prove the profitability of future projects, describe what type of mine will be required, and explain how to manage its environmental and social footprint. Their expertise significantly informs the feasibility studies which assess the costs of each of these (future) actions (NRG, 2015). Like the elaboration of feasibility studies, social and environmental engagements with local stakeholders are usually outsourced to contractors. Most prior studies and surveys (especially those necessary for elaborating an ESIA or a RAP) are usually carried out by (international) consultancy firms on behalf of mining companies – often because this is a requirement of the host government (Dougherty, 2019; Ayehe, 2021). However, contractors (mostly trained social scientists) succeeding geoscientists as “ambassadors” of the mine can be a barrier to the future success of company-community relations, especially if there is no institutionalized cross-functional coordination of all company staff and contractors (IFC 2014).

A mining project's social and environmental impact becomes increasingly apparent during the construction phase, as this is when operational infrastructure (processing and waste disposal facilities, roads for transportation, etc.) and worker accommodation (camps) are set up (Bray, 2013). As John Bray (2003, p. 311–312) emphasizes, the principal goal of many engineers and other senior staff during the construction phase is to lead the mining project into the production stage. They are thus often not committed to deep socio-political analysis which, in their view, often does not lend itself to precise measurement (Ayehe, 2021). Although mining projects in the construction phase usually include their own corporate “social specialists” and sometimes specialized corporate social responsibility (CSR) and environment departments, the governance of mining projects during construction – especially in relation to ethical questions – remains largely improvised (Rubbens, 2020). Interview material from Burkina Faso suggests that the employees of these departments continue to face financial constraints and only have a limited scope of action while having to respond to the multiple expectations of local populations. Although a mainstreaming of ethics into industry practice has led to a mushrooming of technical procedures for stakeholder engagement, their sustainability and effectiveness largely depends on individuals enacting the corporation, including mining engineers and geoscientists.

(3) During operations the ethical dimension of mining projects comes most significantly to the fore as it is seen as the phase where the main conflicts occur with local populations (Bray, 2013). Once a company has successfully obtained its extraction license and has succeeded in mining the first minerals and metals from the subsoil, mining corporations then arrange the financial means and workforce necessary to implement responsible mining more effectively. Operating sites usually have functioning, significantly staffed, and financially backed CSR departments that are seen as the interface between company and community affairs (Kemp and Owen, 2013). Other departments are specialized in the environmental (environment department) or labor-related (human resources department, see Rubbens, 2020) aspects

of responsible mining. Geoscientists and engineers are attached to the different technical departments (e.g. geology or mining engineering) and occasionally exchange with the non-technical ones in case that environmental or social issues occur in their domains. Ethnographic literature indicates that different mining professionals may or may not perceive responsible mining as a priority. Several authors have, for instance, observed a tendency of engineers and technical staff within corporations to consider CSR practitioners as outsiders within corporate structures. The latter rather have a position of weakness than of strength within corporate hierarchies (Welker, 2014; Owen and Kemp, 2017). Evidence from extraction sites in Burkina Faso suggests, for instance, that an older generation of engineers and geologists is described by CSR personal as lacking sensitivity for social and environmental issues due to their educational background (Ayehe, 2021). Geoethical education and principles in this phase might guide geoscientific professionals to put value on cooperation with colleagues that have a different professional background and to apply multi-disciplinary approaches to tackle complex issues (Bobrowsky et al., 2017).

(4) The (post-)closure stage of a mining project is emblematic of its environmental and social legacy. This phase is no longer profitable for a corporation and its shareholders. Thus, projects often change hands from companies to other companies, or more often (if no corporation is eager to inherit the project due to the depletion of resources), to governments of host countries which end up being in charge of rehabilitation (Ayehe, 2021). Yet the phase is crucial for mining-impacted communities (NRG, 2015). It illustrates whether a company and its employees have provided for and implemented important rehabilitation measures during the extraction phase, and whether sustainable mining and CSR programs have achieved their initial goals (e.g. providing local populations with training and livelihood opportunities that extend beyond the extractive industries sector). The role of mining engineers is crucial in that phase in that they provide the technical assessments and works necessary for rehabilitation and (post-)closure. They are in charge of securing and rehabilitating the area around the mine, including the waste piles produced by the mine (NRG, 2015). More recently, this phase has been increasingly taken into account by responsible mining schemes such as the IRMA standard (IRMA, 2018) and a new global industry standard on tailings management (Global Tailings Review, 2020). These standards, however, do not address the ethical challenges that may confront engineers with regard to the social and environmental harms caused by mining projects or the (non-existing) country-specific legislation. Ethical dilemmas can arise, for example, when it is likely that the financial resources for sustainable and safe rehabilitation are not available or when post-mining land use is impossible (Limaye, 2015). Geoethical publications highlight this phase as important for geoethical inspired action (Limaye, 2012; Arvanitidis et al., 2017; Bohle and Preiser, 2019).

Our review of the dominant structural characteristics of the global mining sector suggests that geoscientists and engineers occupy particular roles when it comes to representing companies in given settings and in shaping (future) company-community relations. It also indicates that these professionals face different constraints in practicing responsible mining, depending on the type of company they are working for and the different phases of the mining cycle they are involved in. The aim of corporations in the early phases is primarily to valorize projects through the generation of geological knowledge. This favors a certain professional culture that focuses on the technical and scientific aspects of the work and making mining projects profitable before ethical aspects can play a role. Small exploration teams are usually not in a position to implement ethical standards due to their limited resources, and because such standards are rarely an integral part of the company culture. As a result, individuals cannot expect guidance in situations that cause dilemmas. Geoethics acknowledges the strong pressure that might occur for individuals (Bobrowsky et al., 2017), but could deliver more guidance how to tackle with it. Against this background we argue that the concept of geoethics could be used to add an individual dimension to

institutional ethics in mining (e.g. CSR, SLO, responsible mining). It provides guiding principles for professionals in accordance with responsible mining. In doing so, it challenges dominant notions of corporations as unified ethical actors with one will and serves as a fruitful starting point to study the issues, engagements and challenges of particular professionals in mining governance. In the final section, we will discuss the opportunities and challenges of mainstreaming ethics into mining practice through the concept of geoethics by providing approaches for a future research agenda.

4. Conclusion: mainstreaming ethics into mining practice

Within this paper our starting point was the observation that the ‘ethical turn’ in the metals and minerals sector focuses almost exclusively on the level of organizations, and primarily on corporations as ethical actors. Ethical schemes such as CSR and responsible mining are thought to be implemented by corporations and not individuals. Therefore, they do not explicitly deliver guidance for the latter and do not broach the issue of tensions that arise between individual and institutional responsibility, such as conflicting situations caused by the ethical convictions of individual professionals and the structural conditions of their work. This is the point at which we see our contribution to the ongoing debate on CSR and the field of geoethics: bringing together individual and institutional approaches to responsibility in mining practices. By highlighting existing structures and processes in the global minerals and metals sector, we revealed how and when responsible mining principles are implemented and which structures, processes, and responsible actors they do not cover. We have shown that in situations and phases where CSR concepts are not applied, the individual decision-making of geoscientific professionals is highly relevant. These moments, however, involve manifold ethical issues and individual professionals have to make decisions in the absence of organizational guidelines. This relates mainly to geoscientists and engineers who occupy important decision-making positions and shape company-community relations in significant ways. For geoscientific professionals, the concept of geoethics therefore appears to be particularly useful in situations where institutional ethics (CSR and similar schemes) do not apply or are largely inapplicable (e.g. in the early phases of the mining cycle), or where their application is outsourced to other mining practitioners (e.g. to CSR agents in the production phase). Thus, we argue that to date the ‘ethical turn’ in the metals and minerals sector and guidelines implemented in its name (i.e. responsible mining) fail to take into account the structural complexities (i.e. different actors, timeframes and social relations) and inherent contingencies that constitute the global mining economy. In practice, for instance, the social domain tends to be associated with and delegated to consultants in the early phases of the mining cycle, and to people working in CSR and sustainability departments in the later stages. This leads to a de-responsibilization of geoscientists in terms of ethical issues.

Although geoethics seems to be a promising concept in this regard we see some weaknesses in the current shape of geoethics in the context of mining and therefore argue that this concept needs to be further developed. Notably, we think that the concept, first, needs to go beyond general claims such as the transparency of individual actions and decisions made by geoscientists. It should be more specific and systematic about challenges related to the processes, structures and social relations of and in the mining industry and the goal of responsible mining. Ethical challenges that arise may concern any of the relationships geoscientists maintain: with their colleagues and the geoscientific community, the company they work for, host communities and national institutions, the broader society or the environment. Furthermore, geoscientists play a role in the interactions and relationships other actors have with each other (e.g. national mining administrations and communities in the context of concession-making). A discussion of geoethics in the context of mining should necessarily address related questions such as the following: How could and should a geoscientist professional working for

a Junior company or within the exploration team of a mid-tier or major company consider compensation for livelihood losses in the prospecting phase? How can and should a geoscientist address contradicting interests of corporations and local communities?

Second, the question of professional responsibility needs to acknowledge different positions and hierarchies geoscientists are themselves confronted with in corporations and in the different phases of the mining cycle. The individual decision-making processes of professionals cannot be separated from the structural conditions of their work. Who is to be held responsible, for instance, for overcoming the non-implementation of ethics in the early exploration phase due to scarce human and financial resources: the individual employee, the firm as his employer, or for example those who invest their money in buying corporate stocks in Toronto and London? Mainstreaming ethics into mining practice not only demands personal commitments from individual professionals, but also the organizational and financial backing of responsible mining in all phases of the mining cycle by firms, investors, or multi-stakeholder partnerships.

Third, it is important to clarify and delineate the relation to geoethics’ neighboring fields. It is above all engineering ethics to which geoethics needs to clarify its relations (e.g. [Herkert, 2001](#); [Smith, 2019](#)). In its current conception geoethics addresses both geoscientists as well as engineers in mining without pointing to potential differences. However, the tasks of both professions are very different and may raise different ethical questions. In this article we highlighted points of intersection with ethical guidelines that address corporations. It should be explored if geoethical thinking might contribute to develop industry terms as CSR, responsible mining and SLO further. For example the duty of geoscientists mentioned by [Bohle and Preiser \(2019\)](#) to integrate local knowledge and expertise into geoscientists’ everyday working environments and decision-making processes could contribute to shifting power relations that privilege corporations in the discourse on responsible mining ([Phadke, 2018](#)).

Our review on existing literature on the role of geoscientists in practicing responsible mining indicates that the conceptual framework of geoethics in mining does yet not explicitly address those issues and relationships. In order to provide individual professionals with explicit guidance for action and decision-making, it has to become way more sector-specific. To start with, a systematic investigation of mining actors, structures and processes could be carried out to create a specification of geoethical issues that applies specifically to mining industries. Different company structures and especially all phases of the mining cycle should be considered here. Secondly, existing social science research could enrich and inspire some of the issues addressed by geoethics, such as issues regarding competing responsibilities ([Trundle and Trnka, 2017](#)) or conflicts that may arise between individual employees (such as CSR officers) and the structural dimensions and settings of their working environments ([Kemp and Owen, 2013](#); [Welker, 2014](#); [Owen and Kemp, 2017](#)). Our analysis revealed that geoscientists are particularly involved in “play[ing] between the scales” of different responsibilities ([Müftüoğlu et al., 2018](#), p. 265). A consideration of the (potential) tensions between different ethics in mining (individual and institutional) ultimately allows for a more nuanced picture of competing responsibilities in the global mining sector.

Declaration of Competing Interest

None

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