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Constructing criticality by classification: Expert assessments of mineral raw materials

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ABSTRACT

This paper explores the role of expertise, the nature of criticality, and their relationship to securitisation as mineral raw materials are classified. It works with the construction of risk along the liberal logic of security to explore how "key materials" are turned into "critical materials" in the bureaucratic practice of classification: Experts construct material criticality in assessments as they allot information on the materials to the parameters of the assessment framework. In so doing, they ascribe a new set of connotations to the materials, namely supply risk, and their importance to clean energy, legitimizing a criticality discourse.

Specifically, the paper introduces a typology delineating the inferences made by the experts from their produced recommendations in the classification of rare earth element criticality. The paper argues that the classification is a specific process of constructing risk. It proposes that the expert bureaucratic practice of classification legitimizes (i) the valorisation that was made in the drafting of the assessment framework for the classification, and (ii) political operationalization when enacted that might have (non-)distributive implications for the allocation of public budget spending.

1. Introduction

Mineral raw materials are typically seen as essential components of all national economies (Lusty and Gunn, 2015; Tiess, 2010). However, with the introduction of the term critical material in the late 1930s in the US Strategic and Critical Materials Stock Piling Act, the discourse on critical raw materials, hereafter 'criticality discourse', initiated (US Public Laws, 1939). This discourse links the issue of mineral raw materials with the politics of national security, as the Act authorizes the acquisition of materials for national defence stockpiling to mitigate the supply chain risk of these materials (Humphries, 2013; US Public Laws, 1939).

The criticality discourse was revived in the 1970s and 1980s, and most recently by the US National Research Council (2008) through the *extension to non-energy minerals* where a critical mineral continues to be defined as '*one which is subject to supply risk*' (Barteková and Kemp, 2016, p. 4). In response, the European Commission ([EC], 2008) acknowledged its import dependence of high-tech metals which it pinpointed as critical *'in view of their economic value and high supply risks'*. The EC proposed to launch a European Raw Material Initiative which was to, among other, define critical raw materials. In fact, a multitude of material criticality definitions continue to be constructed on supply risk, analytically tying criticality and supply risk (Jin et al., 2016; Buijs and Sievers, 2011a, 2011b). Key to the current criticality discourse is the assessment of mineral criticality by experts.

Little is known about the role of the experts in these criticality assessments, their methods and impact on the outcome of the assessments. They work for institutions that serve the European Union [EU] and the United States [US] such as the European Commission [EC], or the US Department of Energy [US DoE]. Their assessments concern a dozen materials, and their significance for developing low-carbon, clean energy technologies such as in the EC-Joint Research Council [JRC] (2011) Report on Critical Metals in Strategic Technologies and the US Department of Energy [DoE] (2011) Critical Materials Strategy Report.

Rare earth elements (REEs) have been assessed as critical in both of these reports. The REEs count 15 elements of the lanthanides series in the periodic table, and scandium and yttrium (IUPAC, 2005). Their name is suggestive of rarity, while they are not (Ulmanns, 2005). Rather rare, however, is the successful separation of a REE-bearing mineral into its 16 individual REEs that can be used by industry, a competence that China holds as near-monopoly producer of more than

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80% of the global REE supply in 2016 (Castilloux, 2016).

Resource nationalism observed in China that arguably serves to advance value-added industrial development, is exacerbated by domestic plans of REE industry consolidation, and changes in export policies which restrict REE-flows (Wübbeke, 2013, 2015). These policies advance resource nationalism as they aim to tie geological occurrences of REE and their supply to domestic economic activities. This development and the REE price peaks of 2011 that importers experienced when China used REE as a political tool in its claims to the Japanese controlled Senkaku islands in the East China Sea in 2010, raises concerns about access to REE for import-dependent nations, and make the REEs flagship minerals of the criticality discourse (Barteková and Kemp, 2016; Kiggins, 2015; US EIA, 2014; Mancheri et al., 2013; Erdmann and Graedel, 2011).

Experts play a particular role in this criticality discourse: By assessing minerals through allotting information to the parameters of supply risk and importance to clean energy in a framework that has been designed for the assessment of mineral criticality, they legitimize these, and construct criticality. In so doing, they translate a 'key material' into a 'critical material' by means of classification according to these parameters. They experts also cross the science-policy boundary, using their authority and knowledge, and engaging politically.

Expert authority is crucial in this process, as it functions as legitimation (i) of the parameters of the assessment framework which valorises select aspects (supply risk and importance to clean energy), and (ii) of the recommendations on approaches to mitigating the supply risk, the principal objective of the assessments (Berling and Bueger, 2015; Jin et al., 2016). Through their classification, experts valorize some aspects of the minerals above others and they recommend actions such as research on REE occurrences, production, substitutability and recyclability to be funded by institutions in the EU or the US (EURARE (NERC, 2016); Innovation Metal Corp. [IMC], 2011–2013). They are, thus, complicit in decision-making on the distribution of public wealth, when their recommendations are enacted, as will be explored further on in this paper.

This paper is situated in political and resource geography through its focus on contributing to the discourse that Barry (2013) captured as 'material politics' and it draws on constructivist security studies, especially in relation to the so-called Paris School (Bigo, 2002; Balzacq, 2011a) to explore the role of experts in constructing the criticality of minerals. Its aim is to shed light on the expert role in mineral assessments, and their bureaucratic practice of classification (Bowker and Star, 2000). The paper draws on the liberal logic of security (van Munster, 2009) to unveil how expert assessments, and mineral criticality, are tied to securitization by risk profiling, without necessarily invoking security (van Munster, 2009; Bigo, 2002). It puts forward two propositions:

First, experts are essential in the construction of the meaning of criticality. They legitimize the parameters of the assessment framework, supply risk and importance to clean energy, and valorise it. This occurs as they allot information to the framework in a process of *classification* (Bowker and Star, 2000) that involves risk profiling (van Munster, 2009). The political impact of these expert practices is profound. Through the process of *valorisation*, some things are silenced, such as the geopolitical and economic antecedents to the formation of quasi-monopolistic supply scenarios by one country (policy and regulation, and market competition centred on price), and others are emphasized, such as the territorial focus of geological occurrence, metallurgical- and further processing (Bowker and Star, 2000). The technical dimension in the construction of criticality is at the centre-stage and manoeuvres experts into a position of authority to legitimize this discourse. This is a domain of politics that remains understudied. Likewise, Bakker and Bridge (2006) have argued that the concept of 'construction' is worthwhile revisiting as part of a revival of 'materiality' in human and resource geographies.

Second, the assessments of criticality, when *put to work as a bureaucratic practice* of managing risk along the liberal logic of security, pervade government and society and enable *operationalization*, as attention of policy makers is drawn to specific issues, making new links between the governance of resources, economic development, energy technologies, and national security, and funds can be mobilized to mitigate criticality. This speaks to the 'performative quality', namely 'the political work' that the construct performs, on behalf of its designers, the experts, as bureaucratic practice is put to work (Bridge, 2015). From that I propose that experts are complicit in the redistribution of public wealth toward particular beneficiaries. I conceptualize public wealth here as the percentage-share of gross national income that EU member states contribute to the EU budget. I argue the case for public wealth on the grounds of the EU budget allocation to numerous fields of action, including to research, which are in principle destined to nurture wealth through growth and innovation.

The paper is structured into five sections: The next section describes the theoretical framework. In section three the methodology and data are described. The analysis is presented in section four, jointly with the recommendations put forward in the criticality assessment, and the typology of inferences that I derive from it. The paper concludes with a discussion of the meaning of constructing a mineral as critical in section five.

2. Theoretical framework

In the following subsections, I first describe the origins of the mineral criticality discourse, linking energy (supply) security with mineral criticality, and discussing how risk (of a disruption of supply) bridges these separate but intertwined discourses. The primary concern of energy security rests with hydrocarbons (i.e. oil), in contrast to the emphasis of the criticality discourse on non-energy minerals. This backdrop serves as foundation when I turn to the theoretical discussion of the expert role in securitizing in Section 2.2, where I discuss the *Copenhagen School* and the *Paris School* to draw on the latter, and the *liberal logic of security* to explore the role of experts in constructing the criticality of minerals. In Section 2.3, I turn to the potency of classification with a view to valorisation and operationalization.

2.1. From energy (supply) security to mineral criticality

The literature on supply risk which originated in the late 1930s was augmented during the oil and cobalt crisis in the 1970s, and constitutes the backbone of the current criticality discourses. The 1973 Arab oil embargo triggered the establishment of an energy security system against the disruption of oil supply, historically tying energy security to oil supply. Yergin (2006) described three principles of energy security, namely (i) diversification of supply, (ii) resilience, which refers to a margin or buffer against disruptions, and (iii) the recognition of integration, describing one market that consists of a complex, worldwide system.

Yergin (2006) emphasized that security was to be understood as the stability of this market. The most recent definition of energy security by the International Energy Agency [IEA] reads as '*the uninterrupted availability of energy sources at an affordable price*' (OECD/IEA, 2016). This definition also has a long-term energy security dimension that centres on investments to ensure energy supply, and a short-term dimension with a focus on the reactiveness of the energy system on exposure to distortions, namely 'sudden changes within the supply-demand balance' (OECD/IEA, 2014, p. 13).

Risk (of a disruption) links the definitions of *energy security and non-energy mineral criticality*: Energy security is fundamentally concerned with the management of risk – be it of supply that might be interrupted or unavailable, capacity that might be insufficient to meet demand, prices that might be unaffordable or sources that are unsustainable to rely on. Causes for these risks might be found in energy market instabilities, technical failures or physical security threats (IEA, 2007