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# Natural Resource Extraction, Armed Violence, and Environmental Degradation

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## Abstract

The goal of this article is to demonstrate that environmental sociologists cannot fully explain the relationship between humans and the natural world without theorizing a link between natural resource extraction, armed violence, and environmental degradation. The authors begin by arguing that armed violence is one of several overlapping mechanisms that provide powerful actors with the means to (a) prevail over others in conflicts over natural resources and (b) ensure that natural resources critical to industrial production and state power continue to be extracted and sold in sufficient quantities to promote capital accumulation, state power, and ecological unequal exchange. The authors then identify 10 minerals that are critical to the functioning of the U.S. economy and/or military and demonstrate that the extraction of these minerals often involves the use of armed violence. They further demonstrate that armed violence is associated with the activities of the world's three largest mining companies, with African mines that receive World Bank funding, and with petroleum and rainforest timber extraction. The authors conclude that the natural resource base on which industrial societies stand is constructed in large part through the use and threatened use of armed violence. As a result, armed violence plays a critical role in fostering environmental degradation and ecological unequal exchange.

### Keywords

mining; violence; environmental sociology; ecological unequal exchange; militarism

In recent years, a new body of research has begun to examine the unequal exchange of natural resources and environmentally degrading activities between nations that are differentially located within the international political economy (Rice, 2009). Based in the world systems theory tradition (Bunker, 1984; Emmanuel, 1972), ecological unequal exchange theory holds that because of their position in the world system hierarchy, core nations are able to take advantage not only of the labor power but also of the natural resource wealth of periphery nations, while simultaneously exporting many environmentally degrading activities to the periphery. This, they argue, results in underdevelopment and impoverishment in the periphery and increased wealth and economic power in the core (Jorgenson & Clark, 2009).

Researchers in this subfield have convincingly demonstrated that structural position in the world system hierarchy does, in fact, play an important role in shaping nations' ecological



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exchange relations and, thus, the ability of nations to minimize environmental degradation within their borders and take economic advantage of their own and global natural resources (Rice, 2009). A handful of researchers have also begun to specify the organizational and institutional mechanisms that make ecological unequal exchange possible. For example, scholars have identified agricultural research institutes (Foster, 1994) and military coercion and war (Clark & Foster, 2009; Jorgenson & Clark, 2009; York, 2008) as important mechanisms promoting the transfer of natural resource wealth from the periphery to the core. There is also widespread recognition that structural adjustment and external debt force many developing nations to increase their natural resources exports to developed nations (Bello, Cunningham, & Rau, 1999; Clark & Foster, 2009).

Nevertheless, relatively few ecological unequal exchange researchers have thought systematically about the organizational and institutional mechanisms that underlie ecological unequal exchange; and they and other environmental sociologists have paid only limited attention to the role that armed violence and militarism play in degrading the environment and securing core nation access to developing nation natural resources (Hooks & Smith, 2004, 2005; Jorgenson & Clark, 2009). Moreover, environmental sociologists and ecological unequal exchange researchers who have examined armed violence and militarism tend to ignore several important categories of armed violence and militarism, including armed conflict between state and nonstate actors, violent repression carried out by state and rebel forces, and the use of mercenaries to protect natural resource assets.

To begin filling these gaps in the literature, this article develops a theoretical argument that holds that armed violence is one of several overlapping and mutually reinforcing mechanisms that provide core nations and corporations with the means to control or gain disproportionate access to the natural resource wealth of developing nations, thereby promoting capital accumulation and military power in the core; degrading local, regional, and global environments; and creating the conditions within which ecological unequal exchange can occur.

Our argument, in brief, is that to fully explain the global ecological crisis, researchers need to understand, at a minimum, why wealthy industrial societies are able to extract so many natural resources, at such great volume, from so many places around the world. Obviously, extraction, transportation, communications, and information technology play an important role in allowing this to occur (Bunker, 2005; Bunker & Ciccantell, 2005). However, the ability of wealthy industrial societies to extract vast quantities of natural resources from the earth and get these resources to the factories, farms, and people that need them also requires complex social arrangements that are instituted, organized, shaped, directed, and controlled by specific organizations, institutions, treaties, and laws.

One set of institutions that facilitate resource extraction activities are international trade and finance institutions such as the World Bank, International Monetary Fund (IMF), and World Trade Organization (WTO). These highly coercive institutions have multiple, often violent, negative impacts on individuals, societies, and the environment (Bello et al., 1999; Wallach & Woodall, 2004).[1] However, these institutions do not directly use or control the means of violence, which we argue also play a critical role in maintaining and increasing global natural resource extraction and ensuring the safe transport of raw materials and finished products. The means of violence are, instead, controlled by military, police, mercenary, and

[1]For instance, in the 1980s and 1990s, World Bank and IMF structural adjustment programs played an important role in increasing poverty, hunger, disease, and social disorder in many African and Latin American countries. The social disorder that often resulted from structural adjustment contributed in some cases to higher violent crime rates and, more rarely, to armed rebellion (Bello et al., 1999). However, poverty, hunger, disease, and social disorder are also forms of violence that can have devastating physical and psychological effects.

rebel forces around the world that are usually, but not always, associated with local or national governments and that sometimes act on their own behalf and sometimes to ensure capital accumulation. Thus, we conclude that environmental sociologists and ecological unequal exchange researchers should focus theoretical and empirical attention not only on the relationship between natural resource extraction, raw material transport, armed violence, and environmental degradation but also on the structural role that military, police, mercenary, and rebel forces play in harming the environment.

Of course, there would be no point in doing this if resource extraction activities were rarely associated with armed violence. Thus, in addition to developing our theoretical argument, we also demonstrate that an important empirical link exists between natural resource extraction and armed violence. To establish this link, we use a recent National Research Council (NRC; 2008) study to identify 10 minerals that are critical to the functioning of the U.S. economy and/or military (platinum, palladium, rhodium, manganese, indium, niobium, vanadium, titanium, copper, and rare earth elements) and then ask whether the extraction of these minerals has involved the use of armed violence at any point in the past 10 to 15 years. We define armed violence as violence and threatened violence perpetrated by military, police, mercenary, and rebel forces, and thus we investigate violent acts such as military and police forces beating, arresting, or firing weapons at protestors, the use of mercenaries to provide mine security, the forced removal of local populations, and the use of forced labor to carry out resource extraction activities. We supplement this descriptive, but decontextualized, analysis with a set of case studies that examine more fully the violent activities associated with the extraction of two of these minerals (manganese and copper) and then briefly discuss examples of armed violence associated with the world's three largest mining companies, with African mines that receive World Bank funding, and with petroleum and rainforest timber extraction. Presenting these case studies and briefly discussing these companies, mines, and nonmineral resources allows us to (a) empirically evaluate aspects of our theoretical model that we are otherwise unable to evaluate, (b) address a slight bias in the critical mineral data that we discuss in a subsequent section of the article, and (c) illustrate more clearly some of the ways in which violence is associated with natural resource extraction.

Our goal in doing these things is not to test theoretical predictions drawn from preexisting sociological theory or to empirically examine all the theoretical claims we make in the following sections of the article. Rather, our goal in this article is fourfold. First, to develop a theoretical link between natural resource extraction, raw material transport, armed violence, and environmental degradation that considers armed violence to be one of several important mechanisms that provide corporations and states with the means to extract, transport, and control natural resources that are critical to capitalist production and state power. Second, to demonstrate empirically that developing such a link is theoretically and substantively important. Third, to begin filling the gaps in the ecological unequal exchange and environmental sociology literatures that we identified earlier in this section. Fourth, to demonstrate that armed violence plays a critical role in facilitating natural resource extraction, without which ecological unequal exchange could not occur and much environmental degradation would not occur.

## Literature Review

As previously noted, environmental sociologists have paid relatively little attention to the role that armed violence and military activity play in damaging the environment and ensuring the profitable extraction and transport of natural resources (Hooks & Smith, 2004, 2005; Jorgenson & Clark, 2009). In recent years, however, a handful of environmental sociologists, including several ecological unequal exchange researchers, have begun to

argue that military activity may be a key driver of environmental degradation. These researchers have noted, for example, that military equipment, military bases, weapons production and disposal, and war all produce severe environmental degradation that cannot be attributed solely to the pursuit of capital accumulation (Hooks & Smith, 2004, 2005), that powerful nations often use military coercion to maintain disproportionate access to natural resources (Jorgenson & Clark, 2009; Jorgenson, Clark, & Kentor, 2010; York, 2008), and that military power was one of the key factors that allowed Western Europe to exploit its colonies' labor and natural resource wealth, thereby enriching Western Europe, impoverishing much of the rest of the world, and severely degrading the environment (Foster, 1994). Researchers have also argued that war and debt played an important role in ensuring British control over Peru and Chile's 19th-century natural fertilizer trade (Clark & Foster, 2009) and that imperialism and militarism have played an integral role in cementing U.S. power over global petroleum supplies (Foster, 2008; O'Connor, 1998).

In setting forth these arguments, these scholars make several important contributions to the environmental sociology and ecological unequal exchange literatures. Nevertheless, we contend that in focusing their attention on wealthy nation military power, military violence between nations, and the direct environmental consequences of weapons production, military activity, and war, these scholars ignore several important ways in which violence and armed conflict contribute to local, regional, and global environmental degradation. For instance, although we agree with Hooks and Smith's (2004, 2005) argument concerning the direct environmental effects of war and militarism, we also believe that violence and armed conflict play a critical role in degrading the environment by helping ensure that natural resources vital to both capital accumulation and core nation military power are extracted and transported in sufficient quantities and at low enough prices to (a) maintain or increase corporate profits and industrial production levels across core nation economic sectors, (b) guarantee levels of economic activity sufficient to maintain core nation tax revenues, and (c) provide core nations with the natural resources and tax revenues they need to maintain large, powerful militaries.

Moreover, unlike Foster, Clark, Jorgenson, and York, we contend that the role armed violence and militarism play in ensuring core nation access to natural resources is *not* restricted solely to war between nations: among other things, it includes armed conflict between state and nonstate actors, violent repression carried out by state and rebel forces, the use of mercenary forces to protect natural resource assets, and the use and threatened use of military and police violence against protestors and local populations by states, corporations, and rebel groups.

Thus, in the following sections of the article, we develop a theoretical model that holds that armed violence represents one of several overlapping mechanisms that provide powerful actors with the means to (a) prevail over others in conflicts over natural resource use, extraction, and transport and (b) ensure that natural resources critical to industrial production and state power continue to be extracted and sold in sufficient quantities to promote capital accumulation and state power in the core. We begin by explaining why developing such a model is theoretically and substantively important. We then present the model.

## The Environmental and Sociological Significance of Natural Resource Extraction

The social, political, and economic importance of efficiently extracting and safely transporting natural resources cannot be underestimated. State, military, and geopolitical power, capital accumulation, social stability, industrial production, and the legitimacy of the state and economy all depend on large, increasing, and ever more concentrated withdrawals

of natural resources from the earth (Bunker & Ciccantell, 2005; Gould, Pellow, & Schnaiberg, 2004, 2008; Klare, 2001, 2004; O'Connor, 1996; Schnaiberg & Gould, 2000).

Moreover, because natural resources are the ultimate source of all the energy and goods we produce, consume, and throw away, natural resource extraction harms the environment not only at the "point of extraction" but globally as well. Thus, the grave environmental problems associated with industrial production and consumption (in both capitalist and noncapitalist societies) would not exist, or would not exist in their current form, if industrial societies were unable to efficiently extract and safely transport vast quantities of natural resources.

Computer production, for example, could not occur without the extraction of minerals, fossil fuels, and other natural resources from around the world. One such category of resources is rare earth minerals, which are mined primarily in China (NRC, 2008). The mining of rare earth minerals produces as much as 2,000 tons of solid waste, including toxic heavy metals and radioactive thorium, for every ton of rare earth mineral produced (Farago, 2009; Rong & Yu, 2009). In China, it also results in topsoil loss, erosion, and widespread silting and contamination of rivers and reservoirs used for drinking and irrigation (Xu & Liu, 1999).[2]

Computers also harm the environment during the production, assembly, consumer use, shipping, disposal, and recycling stages of their lives and thus affect the environment and human health around the world. Environmental impacts during these stages of a computer's life include abiotic depletion, global warming, the release of toxins into the environment, human exposure to highly toxic materials, acidification, ozone depletion, the formation of photoxidants, and water eutrophication (Choi, Shin, Lee, & Hur, 2006). Because computing power is so critical to globalization and economic growth, computer use also helps foster environmental problems associated with these phenomena.

It would be difficult to argue, therefore, that the environmental problems associated with computer use and production are confined solely to the resource extraction stage of the commodity chain or that the environmental problems associated with the remaining stages of a computer's life would exist without the extraction of the minerals, fuels, and other natural resources needed to produce, ship, use, recycle, and dispose of computers. This is true, of course, of all the products we use and produce, including weapons systems, automobiles, solar panels, and cell phones. Thus, resource extraction is a pivotal link in the chain connecting human activity and social organization to environmental degradation.

Given the fundamental importance of natural resource extraction and transport to capital accumulation, state power, and environmental degradation, as well as the importance that control over natural resources plays in shaping local, national, regional, and global distributions of power (Bunker & Ciccantell, 2005; Klare, 2001), we believe it is imperative that environmental sociologists develop theoretical models that explain how powerful actors simultaneously attempt to ensure both their control over natural resources and the efficient and affordable extraction and transport of these resources. In the following section, we develop one such model.

However, before proceeding, it is important to note that in arguing that armed violence plays a critical role in ensuring capital accumulation and nation-state power, we do not mean to imply that core and periphery nations use or support resource-related violence for the same reasons or that states, rebels, mercenaries, and corporations that support resource extraction

[2]Tantalum is another mineral critical to computer production (NRC, 2008). The global market for tantalum helped fuel a 6-year war in the Democratic Republic of Congo that resulted in millions of deaths and severe environmental devastation (United Nations, 2002), including extensive deforestation, erosion, water pollution, and wildlife loss (Harden, 2001).

activities all have the same motivations for doing so. We discuss the implications of this in some detail in a subsequent section. The important point for now is that the validity of our theoretical model does not depend on these different groups of actors following the same decision-making logic or having the same set of motivations for supporting resource extraction.

## The Theoretical Model

In developing our theoretical model, we start with the assertion that those groups that successfully control, extract, and transport natural resources in specific places at specific times are able to do so because they have created overlapping institutional, organizational, ideological, legal, and technological mechanisms that provide them with the means to prevail over others in conflicts over natural resource use, extraction, and transport. For example, Bunker and Ciccantell (2005) demonstrate that over the past 600 years, breakthroughs in transportation technology have resulted in dramatically increased levels of natural resource extraction, resource extraction from ever more remote locations of the world, the geographic expansion of the world economy, and trade dominance for those nations that control the new technology and as a result, have the greatest access to inexpensive natural resources.[3]

Of course, transportation technology alone does not ensure access to affordable raw materials, especially when those materials are located in other nations or in areas controlled by other groups. Thus, since World War II and the breakup of Europe's colonial empires,[4] wealthy nations and corporations, which consume the bulk of the world's natural resources (Hawken, Lovins, & Lovins, 1999; Speth, 2005), have relied on a combination of mechanisms that they control, including ideology (e.g., neoliberalism; Goldman, 2005), debt (Bello et al., 1999; Clark & Foster, 2009), agricultural research institutes (Foster, 1994), export credit (Evans, Goodman, & Lansbury, 2002), political risk insurance (Moody, 2005, 2007), the WTO (Wallach & Woodall, 2004), the World Bank, and the IMF (Bello et al., 1999; Goldman, 2005), to ensure their continued access to and control over vital raw materials.

Among other things, these institutions, organizations, and ideologies have worked collectively to open the economies of developing nations to corporate investment, increase the flow of natural resources from developing to developed nations, create new legal structures and government institutions that facilitate foreign involvement in developing nation economies, and garner developing nation support for corporate activities, including resource extraction activities, within their borders (Bello et al., 1999; Goldman, 2005; Harrison, 2004; Moody, 2007; Potter, 2000; Structural Adjustment Participatory Review International Network, 2004; Toussaint, 2005; Vorley, 2004; Wallach & Woodall, 2004).

However, nations and societies are not monolithic entities, and regardless of whether a government willingly or unwillingly engages in specific resource extraction activities, whether these activities are organized by local or foreign companies, or whether they occur in developed or developing nations or in nations with strong or weak legal and property rights regimes, it is likely that in many cases individuals and groups will protest, resist, or rebel against these activities. For example, protestors might be worried about local

[3]Bunker and Ciccantell (2005) further argue that the development of new transportation technology is contingent on the creation of financial, organizational, and institutional mechanisms that channel resources and structure relations "within and across firms, sectors, and the state" (p.18) in such a way as to mobilize the resources needed to create technological breakthroughs and fund large-scale infrastructure development.

[4]Colonialism is, of course, an important mechanism that powerful nations have used to exert control over natural resources (Foster, 1994).

environmental degradation or health problems that result from resource extraction activities, they might be aggrieved by any loss of livelihood that they and their community may experience as a result of these activities, or they may be forced to relocate in order to make way for resource extraction (Structural Adjustment Participatory Review International Network, 2004). Similarly, workers hired by resource extraction firms may protest poor working conditions, local residents may receive few of the benefits but all of the burdens associated with resource extraction activities, or local residents may be indigenous, colonized, or otherwise marginalized people who resent government and outsider intrusion into their lives (Evans et al., 2002; Gedicks, 2001; Moody, 2007).

In such instances, local and national governments, resource extraction firms, or rebels who control natural resources may feel that they have no choice but to use violence or the threat of violence to protect their resource extraction activities. Violent actions and threats of violence might include the forced relocation of local residents; the use of police, military, or mercenary forces to break up protests, arrest protestors and provide mine security; and the repression of local indigenous people from whose ranks protestors have emerged or might emerge. Violent actions might also include military conflict with groups that threaten resource extraction activities and foreign military aid and training to local police and military forces.

Of course, armed violence may occur even in the absence of protest. For example, forced labor may be used to decrease labor costs or because working conditions are horrendous, and forced removal may occur in the absence of protest to either forestall protest or because there is no way to extract resources with people living on or near the extraction site. In either case, violence or threatened violence will likely be necessary because most people do not want to be forced to work or leave their homes.

The use or threatened use of violence to gain or maintain access to vital raw materials may also occur in situations in which a resource that is viewed as being critical to national survival and economic prosperity, such as oil or water, is located in an area controlled by others in which mechanisms such as trade liberalization or structural adjustment have not effectively guaranteed permanent supplies of or control over the resource (see Klare, 2001, 2004, for detailed discussions of this type of situation). In such cases, governments might resort to actions such as militarily enforced trade sanctions, counterterrorism activities, proxy wars, military threats, invasion, or providing military aid and training to local police and military forces.

Finally, because land and water transport is potentially subject to piracy or military disruption, governments may devote military resources toward protecting specific resource shipments (such as U.S. protection of Kuwaiti shipping during the Iraq–Iran war in the 1980s) or providing security for roads, railroads, and naval shipping lanes (Klare, 2001, 2004).[5]

## Corporations, States, and Rebels

Central to our argument is the position we take on the question of whether core states, periphery states, corporations, and rebels have the same interests regarding natural resource extraction, resource-related violence, and capital accumulation. We expect that in most instances, rebels, corporations, and states use violence or the threat of violence in

[5]It should be clear from these examples that we agree with York (2008), Jorgenson et al. (2009, 2010), and others (Clark & Foster, 2009; Foster, 1994, 2008; O'Connor, 1998) that core nation military power and military violence between nations play an important role in ensuring core nation access to periphery nation natural resources. Our argument in this article is that these are only two of the ways in which armed violence contributes to ecological unequal exchange.

association with resource extraction activities to achieve their own goals, such as enriching themselves, increasing their power over others, maintaining social stability, or securing good relations with other actors. It is true, of course, that states face structural constraints that shape their behavior and that government policy is shaped directly and indirectly by powerful economic actors (Bello et al., 1999; Domhoff, 1990; Dreiling, 2001; Toussaint, 2005). Nevertheless, research demonstrates that state interests are not reducible to capitalist interests or to structural constraints imposed on them by others (Giddens, 1985; Hooks & Smith, 2004; Mann, 1986). Instead, states have political, military, bureaucratic, and geopolitical concerns that are often quite distinct from those of corporate actors, and powerful states often act effectively on these concerns (Hooks & Smith, 2004, 2005).[6]

But regardless of whether states that support natural resource extraction and resource-related violence do so for their own reasons, because capitalists want them to do so, or because they face structural constraints imposed on them by others, their decision to use or support the use of armed violence is still implicated in environmental degradation and capital accumulation if the violence or threatened violence contributes to these outcomes. In other words, states and corporations do not need to follow the same decision-making logics or be motivated by the same set of interests for state violence to support capital accumulation. The same is true for resource-related violence perpetrated by rebels and mercenaries.

Developing nations, of course, have very different interests than do core nations. They also have much less power than do core nations. As a result, in developing nations, the decision to use violence or the threat of violence in order to protect resource extraction activities is likely to be strongly shaped by structural constraints imposed on them by wealthy governments, corporations, and international institutions.

For example, structural adjustment programs imposed on developing nations by the World Bank and IMF often force developing nations to maintain high levels of raw material exports (Bello et al., 1999); and in cases where mining projects require political risk insurance, developing nations are sometimes forced to agree that they will pay out potentially large insurance claims if mining activities are disrupted in any way (Moody, 2005, 2007). Developing nations' high levels of debt and their resulting dependence on wealthy nations, the World Bank, the IMF, and corporate foreign investment also force developing nation governments to worry about how these organizations and states evaluate their activities. As a result, developing nation governments may feel that regardless of their own motives and interests, they have to use all means necessary to protect resource extraction activities so as to meet their debt obligations, ensure continued foreign investment, and minimize conflict with more powerful nations and institutions.

Thus, the use of violence by developing nations to protect resource extraction activities may be strongly conditioned by the overlapping institutional, organizational, ideological, and legal mechanisms that we argue provide corporations and wealthy nations with the means to control natural resources and prevail over others in conflicts over natural resources. If this is correct, it implies that violence is one of these important overlapping mechanisms even when developing nations make the actual decision to use violence. It also implies that even though wealthy nations, corporations, and the institutions they control likely shape the conditions within which such decisions are made, these powerful actors are often able to separate themselves from these decisions and thus (a) claim that they are not responsible for

[6]Given their strong support for free trade agreements that facilitate global capital accumulation, we believe that a strong case can be made that wealthy nations work actively to ensure global capital accumulation. Nevertheless, achieving this goal is clearly in the direct interests of wealthy states since the wealthiest corporations in the world are domiciled almost entirely in the world's wealthiest nations.

the violence and (b) present their control over natural resources as the result of the rational and just functioning of the world market. It further suggests that developing nations can take actions that support global capital accumulation and the power of wealthy nations and multinational corporations even when they are acting to achieve much more narrowly defined and self-serving goals. Finally, it suggests that armed violence is not only an important driver of environmental degradation, it is most likely also a key mechanism contributing to the unequal exchange of natural resources between core and periphery nations.

## Mining and Violence

We have argued that armed violence is one of several overlapping mechanisms that provide powerful actors with the means to (a) prevail over others in conflicts over natural resource use, extraction, and transport and (b) ensure that natural resources critical to industrial production and state power continue to be extracted and sold in sufficient quantities to promote capital accumulation and state power in the core. If this argument is correct, it suggests that natural resource extraction and transport are likely to be associated with armed violence in many instances, but that the successful operation of other "resource extraction" mechanisms, such as property rights regimes, debt, and IMF lending, will often preclude the need for armed violence.

To empirically evaluate the argument that natural resource extraction is often associated with armed violence, this section asks whether armed violence is or has been associated with the extraction of ten minerals that are critical to the U.S. economy and/or military and, if so, what types of armed violence have been associated with these extractive activities.[7] As noted above, we define armed violence as violence and threatened violence perpetrated by military, police, mercenary, and rebel forces. We recognize that this definition is fairly narrow and ignores less overt, but no less damaging, forms of violence that other scholars have highlighted, such as the physically and psychologically damaging effects of poverty, racism, IMF structural adjustment programs, and capitalist property rights regimes, and the environmental, human, cultural, and social devastation that often accompany mining. We also recognize that some of these forms of violence are associated with mechanisms that interact with armed violence to provide core nations with disproportionate access to periphery nation natural resources. Nevertheless, we restrict our attention to armed violence because environmental sociologists have paid so little attention to it and because we believe that armed violence plays an important and unique role in ensuring core nation access to critical natural resources.

The minerals we consider are platinum, palladium, rhodium, manganese, indium, niobium, vanadium, titanium, copper, and rare earth elements (platinum, palladium, and rhodium are

[7]We do not attempt to show that ecological unequal exchange occurs for the specific minerals that we investigate because other researchers have convincingly demonstrated that natural resources flow unequally from periphery to core nations (Rice, 2009). For example, prior research shows that in Africa, foreign mining companies generally import their own equipment and specialized employees from outside the African continent, export the minerals they extract in African nations to other countries for processing and manufacture (processing and manufacture provide much more value added than does mining), pay exceedingly low royalty fees to African governments (in large part because of World Bank pressure on developing nations), and evade already low taxes (DanWatch & Concord Danmark, 2010; UN Conference on Trade and Development, 2005). Thus, it should come as no surprise that a sizeable increase in mining company profits between 2002 and 2006 was not associated with an increase in mineral revenues in mineral-rich African nations (DanWatch & Concord Danmark, 2010); that in Ghana in 2003, the government earned only 5.2% ($46.7 million) of the value of its total mineral exports ($893.6 million); and that in Zambia, one of the poorest nations in the world, the government exempted Konkola Copper Mines from the nation's Mines and Minerals Act, which only requires that companies pay a 3% royalty rate. As a result, the mine only paid a 0.6% royalty rate ($6.1 million) in 2006–2007 on more than the one billion dollars in revenue (Dymond, 2007). The same basic trend has also been identified in Latin America (Kumar, 2009), especially in mineral-rich Peru, where government revenues actually decreased in 2006–2007 despite skyrocketing mineral commodity prices (Salazar, 2008) and where many multinational mining companies pay no royalties at all (Salazar, 2008).

collectively referred to as platinum group metals). We selected these minerals for examination based on a National Research Council study (NRC 2008) that evaluated how critical each of a larger set of minerals is to the U.S. economy and U.S. national security. The NRC based its evaluations on quantitative and qualitative measures that included for each mineral, the proportion of that mineral's U.S. consumption that is devoted to producing specific types of products (such as electrical components, aerospace materials, integrated circuits, and energy-provisioning materials), the overall economic importance of "the industrial sector encompassing the dominant use of the mineral (NRC, 2008, p. 112)," the importance of the mineral's end use products to U.S. military preparedness, and how difficult and expensive it would be to provide an equivalently useful substitute for the mineral if its price increased dramatically or its supply was drastically cut.[8]

Because each mineral in the NRC report has multiple end uses, we selected for examination those minerals that received the report's highest "supply disruption" score for at least one of its end uses. These scores range from 1 to 4, with a score of 1 indicating that a supply disruption would have little impact on the U.S. economy or national security and a score of 4 indicating a high level of potential disruption due to a lack of suitable alternatives for that particular end use.

Table 1 lists the 10 minerals, the end uses for which each mineral received a supply disruption score of 4, the nations that have the largest reserves and highest production levels of each mineral, and (in parentheses) the percentage of reserves and production that each of these nations contributes to the world total. The information in Table 1 indicates that the 10 minerals play a critical role in the production of a variety of economically and militarily important products, including steel, cast iron, superalloys and nonsteel alloys (such as those used in the aerospace industry), coatings (including for flat panel screens), electronic devices, autocatalysts for motor vehicle emissions control, magnets for digital storage and other high-tech applications, aircraft, medical products, energy provisioning, and power production.

Table 1 also indicates that six of the 10 minerals are produced primarily in Russia, China, and/or South Africa, with Brazil, Canada, Australia, and Chile producing large amounts of some of the minerals and other nations producing smaller amounts of some of the minerals. The geographic distribution of the minerals included in Table 1 is due in part to the NRC's concern with minerals that are located in unstable regions of the world or in nations that are more likely to withhold resources from the United States (Russia and China) and may bias, to some degree, the findings presented in Table 2. We attempt to compensate for this potential bias by recording acts of armed violence that occur or have occurred in nations that are both major and minor suppliers of these minerals and by discussing, in subsequent sections of the article, violence related to the world's three largest mining companies and to the extraction of other critical minerals and raw materials.

To examine the link between mining and armed violence, Table 2 indicates whether armed violence is associated with the extraction of any of the 10 minerals and, if so, what form this violence takes and in which country or countries the violence occurred (in Table 2, the three platinum group metals are listed as a single entry). The table lists seven forms of armed

[8]We focus on minerals critical to the U.S. economy and national security because the United States has the largest economy and military in the world. Nevertheless, the minerals in our list are critical to many core nation economies and militaries and to the global economy as well. For example, platinum, palladium, and rhodium are essential components in the production of automobiles around the world; manganese, niobium, vanadium, and titanium are necessary for global metal and alloy production; copper is an essential element in the global electronics and power production industries; and rare earth minerals are critical to global computer production (NRC, 2008). Thus, our study has significance not only for the United States and the nations where the minerals are mined but for other core nations and the global economy as well.

violence and threatened violence, which include the following: direct military or police actions have been taken against antimine protestors or rebels; military, police, or mercenary forces provide mine security; the government is highly repressive; mining operations have resulted in the repression of indigenous or colonized peoples; local residents have been forced to leave their homes to make way for the mine (forced removal); forced labor or prison labor has been used in the mine or to make the mine operational; and "other forms of armed violence," a residual category that includes forms of armed violence not captured by the other six categories.

We include *military and police actions against protestors and rebels* and *repression of indigenous or colonized peoples* because these are direct examples of armed violence being used to promote mining operations and because such actions imply the possible use of armed violence in the future, and thus also represent a threat of future violence. In addition, even after a group has been colonized, continued domination of the group is likely to be supported at least in part by armed violence or direct threats of armed violence. We include *forced labor*, *prison labor*, and *forced removal* because these forms of coercion are all backed by the threat of armed violence and often by the actual use of armed violence, and we include *mine security by the military, police, and mercenaries* because this use of military, police, and mercenary forces represents a clear threat of armed violence and sometimes involves the actual use of armed violence. The use of military and police personnel to provide mine security also indicates some sort of formal or informal agreement between the mining company and the state concerning the use of armed violence.

Finally, we include *highly repressive regimes* because in such regimes all state-supported activity (including resource extraction) is backed by the threat of armed violence. In addition, highly repressive regimes routinely use the threat of armed violence and imprisonment to forestall protest and minimize open political conflict, thereby reducing the likelihood that local residents will voice their grievances against mining operations. As a result, repressive regimes may not need to use direct acts of armed violence to maintain mining operations, relying instead on overall levels of violence and fear to achieve their mining goals. Because repressive regimes generally censor news accounts and restrict the movement of people and journalists within their borders, it is also the case that news organizations may have difficulty reporting accurately about these regimes' violent actions.

To determine whether governments are highly repressive, we used the Political Terror Scale (PTS), which is "generally considered to be the most valid and … widely employed [measure of repression] in the [political science] literature" (Davenport, 2007, p. 79). The PTS rates countries on a scale from 1 to 5, with 5 being the most repressive; and we designate as highly repressive those countries with a score greater than or equal to 3.[9] A score of 3 indicates that "There is extensive political imprisonment, or a recent history of such imprisonment … [that] [e]xecution or other political murders and brutality may be common … and that [u]nlimited detention, with or without a trial, for political views is accepted" (Gibney, Cornet, & Wood, 2009). A score of 5 indicates that "[t]error has expanded to the whole population … [and that] the leaders of these societies place no limits on the means or thoroughness with which they pursue personal or ideological goals" (Gibney et al., 2009).

[9]The PTS provides two sets of scores, one based on information provided by Amnesty International and the other on information provided by the U.S. state department. Since state department evaluations may be shaped by U.S. geopolitical interests, we used the Amnesty International scores. In addition, because PTS scores can vary considerably from one year to the next due to fluctuations in the use of state violence, we used a 10-year average (1998–2007) to calculate each nation's political terror score. The one exception to this is Gabon, for which Amnesty International data do not exist for these years. Nevertheless, we define Gabon as having a highly repressive government based on our reading of U.S. government and other documents (see the manganese case study).

With the exception of the PTS scores, the information included in Table 2 (and in the case studies presented in the following sections) was obtained through archival research. We first consulted the U.S. Geological Survey's (USGS) *Mineral Commodity Summary* (USGS, 2008) and *Minerals Yearbook* (USGS, 2006) to determine which countries were the major and minor producers of each mineral and to identify individual mines responsible for a substantial proportion of each mineral's world production. We then conducted a series of LexisNexis searches to determine whether armed violence is or has been associated with the extraction of any of these minerals. We instructed LexisNexis to search in major world newspapers printed in or translated into English, and used search phrases that included items such as "copper & Indonesia & violence," "manganese & Gabon & police," and "Grasberg & mine & military." To gather information unavailable in newspaper accounts, we supplemented the LexisNexis searches with Internet and library research as needed, using websites such as those published by the following organizations: Mines and Communities (www.minesandcommunities.org), Business and Human Rights (www.business-humanrights.org), and *Yale Environment 360* (www.e360.yale.edu).

It is important to note that we restricted the LexisNexis searches to acts of armed violence occurring in periphery and semiperiphery nations in the past 10 to 15 years, though we sometimes learned of earlier acts of armed violence through our supplemental research. We restricted the searches to this time period in order to demonstrate that the use of armed violence currently plays a key role in ensuring core nation access to critical natural resources and because LexisNexis rarely provided us with relevant articles further back than 10 years. We focused on periphery and semiperiphery nations since one of the main goals of the article is to contribute to the literature on ecological unequal exchange, which occurs between core nations on the one hand and periphery and semiperiphery nations on the other.[10]

It is also important to note that the evidence we obtained using our archival search strategy probably underrepresents the extent to which armed violence is used to facilitate critical mineral extraction in the periphery and semiperiphery. First, it is likely that acts of armed violence associated with mineral extraction often escape the attention of the world's largest newspapers. Second, because we restricted our search to major newspapers that publish in or are translated into English, we were unable to obtain evidence from smaller newspapers and from newspapers that are not published in or translated into English. Third, many of the world's major mineral producers are countries (such as China, Colombia, Indonesia, and Russia) in which the press enjoys limited freedom, making it less likely that violent actions taking place in these countries would show up in our search. Fourth, it was very difficult to obtain any information about two of the critical minerals we examine (indium and vanadium) because they are both found in a broad range of mineral compounds, making it difficult to identify where they are mined.

Turning to Table 2, we see that armed violence is associated with the extraction of most of the critical minerals examined in this study. For example, for these critical minerals, violent actions against protestors have occurred in South Africa, Malaysia, China, Brazil, Tibet, Sierra Leone, Indonesia, and Papua New Guinea.[11] Mercenaries and military personnel have

[10]As should be clear from our prior discussion, we are not arguing that core nations do not use or support the use of armed violence to achieve their goals, that they do not or have not used armed violence in support of mining activities within their own borders, or that armed violence does not benefit core nations. In fact, an important element of our argument is that core nations and the institutions they control often shape the decisions that noncore actors make, including the decision to use armed violence. Moreover, to the extent that core nations (a) provide noncore nations with military equipment and training, (b) support repressive governments in noncore nations, or (c) directly take part in decisions regarding the use of armed violence in non-core nations, they are directly implicated in armed violence in these nations.

[11]Although not specified in Table 2, these actions range from armed police facing off against protestors but not moving beyond the threat of violence to police firing on and killing protestors (South Africa) to open warfare against rebels (Papua New Guinea).

provided mine security for these minerals in Sierra Leone and Indonesia, and the mining of these minerals has occurred under repressive regimes in the Soviet Union, Russia, South Africa, Inner Mongolia, Tibet, China, Brazil, Gabon, Indonesia, Papua New Guinea, Myanmar, the Philippines, India, and Mexico, and has involved the repression of indigenous or colonized people in Inner Mongolia, Tibet, Brazil, Papua New Guinea, and Indonesia. In addition, the extraction of these minerals has involved the forced removal of people from their homes in South Africa, Brazil, Sierra Leone, and Kenya; the use of prison labor or forced labor in the Soviet Union and Myanmar; and the use of other forms of armed violence, including threatened arrests, solitary confinement, sleep deprivation, rapes, and killings, in Russia, Malaysia, Brazil, China, Kenya, and Indonesia.

These findings provide strong support for our argument that the extraction of critical natural resources is often, though by no means always, associated with armed violence (especially when we recall that it was nearly impossible for us to ascertain whether armed violence is associated with indium and vanadium mining). However, in presenting these findings in table form, we only provide readers with a partial understanding of the violent context within which the mining of critical minerals sometimes occurs. Moreover, the evidence presented in Table 2 does not allow us to evaluate any of our theoretical claims about why mining is likely to lead to violence.

Thus, the following section examines more fully the violent activities associated with the extraction of two of the critical minerals: manganese and copper. We selected these critical minerals for closer examination because their extraction is associated with armed violence in multiple countries, because there are clear variations in the types and levels of armed violence associated with each of them, and because doing so allows us to examine several of our theoretical claims. Thus, our purpose in discussing them further is not to argue that mineral extraction is always associated with armed violence or with extremely high levels of armed violence, but rather, to evaluate our theoretical model more completely and illustrate more clearly how integral armed violence can be to the extraction of critical mineral resources.

## Manganese and Copper

Manganese is a widely used mineral essential for making steel. It is also used to produce nonsteel alloys and batteries (USGS, 2006). According to the NRC (2008), the United States is almost entirely dependent on imported manganese, for which there are no known technical substitutes. In 2006, the leading producers of manganese ore were South Africa (19%), Australia (18%), China (13%), Brazil (12%), and Gabon (11%; USGS, 2006). Armed violence is directly associated with manganese extraction in at least two of these countries (China and Brazil) and indirectly in a third (Gabon).

For example, in Xiushan County, China, there are 41 licensed and more than 200 unlicensed manganese mines, which in 2008 accounted for a large share of China’s total manganese production (Jigang & Chuhua, 2008). These mines have drained the region’s aquifers and illegally dumped tons of toxic waste into the region’s waterways. As a result, local wells run dry when rainfall is low, local rivers and irrigation water are severely polluted, and the region’s rice harvest has been cut in half. In addition, constant mine blasts have cracked the foundations of residents’ homes and impaired local air quality (Jigang & Chuhua, 2008).

To protect their livelihoods and health, some county residents confronted local authorities in 2005 by blockading mine entrances and demanding the enforcement of environmental regulations. They also sought adequate compensation for their losses. One notable blockade, which lasted more than a month, was mounted by 40 elderly women (Jigang & Chuhua, 2008). Mine authorities responded to these actions by hiring thugs to beat protesters, and

Chinese police responded by raiding the town of Gaodong and detaining all townsmen older than 16 years of age for interrogation (Jigang & Chuhua, 2008).

Elsewhere in China, residents of Xialei, in Guangxi Province, conducted a nonviolent sit-in protest in 2006 to stop development of a local manganese electrolysis plant (Xi, 2006). Manganese mining already polluted the community's drinking water, which comes from the Heishui River. Thus, the goal of the protest was to prevent further pollution by blocking development of the plant (Xi, 2006). When two of the protesters were arrested, more than 1,000 Xialei residents gathered in front of the town hall to demand their release. In response, Chinese authorities mobilized several hundred police officers from surrounding communities, who beat the protestors and shocked them with electric batons (Xi, 2006). Five residents associated with the protest were arrested and charged with "gathering a crowd to attack a state organ" (BBC, 2006).

Manganese extraction is also associated with armed violence in Brazil. Brazil's largest manganese deposit, in the Carajas region of the Amazonian Basin in Para state, is mined by Companhia Vale do Rio Doce (CVRD/Vale) at its Azul mine (USGS, 2006) and by Prometel Produtos Metalurgicos (PPM) at its Buritirama mine (*Mining Magazine*, 1993). Prior to the 1970s, the Carajas region was very remote and difficult to reach. However, the largest iron ore deposit in the world was discovered there in the 1960s; in 1971, manganese ore was discovered in the region; and in 1978, CVRD/Vale undertook a massive project, which received considerable state financing and foreign capital, to build a railway link between Carajas and the Atlantic Ocean (Shaw, 1990).

The project, which was completed in 1985, severely degraded the environment. It also led to the involuntary removal of many indigenous people from their land due to the granting of hundreds of prospecting concessions in the newly opened area (Rocha, 1986) and a massive influx of miners, loggers, ranchers, and settlers. The massive influx of new people into the region not only pushed indigenous people from their land, it also made them the victims of violent attacks in the scramble for land and resources (Survival International, 2000).

Peasants and indigenous people in the region have also suffered violent attacks at the hands of the Brazilian government. For example, upon completion of the Carajas Grande Project, Brazil sold a great deal of land in the region to large corporations, including one parcel that it sold to CVRD/Vale. When CVRD/Vale evicted farmers from this parcel, the farmers and other peasants mounted a road blockade to pressure the government and CVRD/Vale to provide compensation for their loss of land and livelihoods (Amnesty International, 1998). Military Police, who were transported to the area in CVRD/Vale vehicles, responded by beating and shooting the protesters, leaving 19 dead and wounding an unspecified number of others (Amnesty International, 1998).

The success of the Carajas Grande project was also dependent on the construction of a large hydroelectric dam to provide power for mineral development (Hall, 1989). To make way for the dam, the repressive Brazilian government expropriated the land of some 30,000 people, including land in two areas previously declared "indigenous reserves" (La Rovere & Mendes, 2000). The dam degraded fisheries, flooded farmland, destroyed rainforests, created the conditions for malaria epidemics, and left thousands landless (La Rovere & Mendes, 2000). In addition, Brazil used a defoliant similar to Agent Orange to clear the way for transmission lines to and from the dam, which may have increased the incidence of death, miscarriage, and illness in the area (La Rovere & Mendes, 2000). Communities that protested against these conditions and demanded compensation for their losses were met with state repression. For instance, police attempted to disperse one large protest

encampment with teargas and blocked some protesters' access to food, clean water, and other provisions (Hall, 1989).

Thus, in both Brazil and China, the government used armed violence to suppress activists who were protesting the negative repercussions of manganese mining. Consistent with our argument, these negative repercussions included environmental degradation, health problems associated with mining and the use of defoliants, forced removal (in Brazil), and the loss of livelihoods due to forced removal and the loss or degradation of fisheries, farmland, and rice harvests. Also consistent with our argument, forced removal occurred in Brazil because large numbers of people lived in areas where mining concessions were granted or flooding from the new dam was to occur.

The relationship between manganese mining and armed violence is less direct in Gabon, which produced 72% of the manganese used in the United States in 2006 (NRC, 2008). For example, although we found no reports of armed violence specifically being used to support Gabon's manganese industry, Gabon is an undemocratic country with a ruling elite that both controls the nation's military and paramilitary forces and benefits directly from the nation's mineral wealth. The Gabonese government, which had only one President from 1967 to 2009, also regularly violates its citizens' human rights. Violations include the following:

> the limited ability of citizens to change their government; the use of excessive force, including torture, on prisoners and detainees; harsh prison conditions; violent dispersal of demonstrations; arbitrary arrest[s] and detention; an inefficient judiciary susceptible to government influence; restrictions on the right of privacy; restrictions on freedom of the press, association, and movement; widespread harassment of refugees by security forces; widespread government corruption; violence and societal discrimination against women and noncitizen Africans; trafficking in persons, particularly children; and forced labor and child labor (U.S. Department of State, 2006a).

Under such conditions, it is unlikely that citizens will be willing to protest local mining activities, giving the Gabonese government little reason to use armed violence to directly protect these activities. Nevertheless, because all state-supported activity in highly repressive regimes such as Gabon's is essentially backed by the threat of violence, we believe it is fair to argue that armed violence and the threat of armed violence play a critical role in facilitating Gabon's mining operations. Moreover, Gabon's restrictions on freedom of the press and freedom of movement mean that media coverage and human rights reports may inaccurately or incompletely portray the nation's mining related activities.[12]

## Copper

Copper is essential to the functioning of the U.S. and global economies because of its importance in the building and construction industries, the manufacturing of transportation equipment, industrial equipment, and machinery, and the generation and transmission of electricity. To some extent, substitutes are available for some of these end uses, but there is no substitute for electricity generation and transmission (NRC, 2008), without which the U.S. and global economies would ground to a halt.

Copper mining is very much associated with armed violence and military activity. Nowhere is this association more clear than in West Papua, Indonesia. Freeport-McMoRan first began mining copper and gold in West Papua in 1972 but significantly ramped up its West Papuan production when it undertook development of its Grasberg mine in 1988 (in partnership with

[12]For example, Amnesty International provides no information on human rights in Gabon.

Rio Tinto and the Indonesian government). The Grasberg mine is one of the largest copper mines in the world, producing approximately 1,644 tons of copper and 700,000 tons of mine waste a day (Freeport-McMoRan, 2007; Perlez, 2006a).[13] This waste is carried away by rivers into wetlands and estuaries, which at one time were among the most productive fisheries in the world. However, mining pollution caused massive fish die-offs and few fish live in the polluted waterways today (Perlez & Bonner, 2005). Moreover, because of acid leaching, mine waste will remain dangerous for years to come (Perlez & Bonner, 2005).

Mining activities have also resulted in the forced removal of indigenous people from their homes and the destruction of areas that hold religious and cultural significance to them. In addition, forced removal and environmental degradation have resulted in economic hardship and loss of subsistence livelihoods for indigenous people who live near the mine (Walton, 2001).

Further increasing tensions in the area, West Papua has been unwillingly subjected to Indonesian rule since the 1960s and is inhabited by individuals who have darker skin, distinct native languages, and different religious practices than other Indonesians (Perlez & Bonner, 2005). Due to these and a variety of other factors, including widespread human rights abuses by the Indonesian army and the destruction of West Papua's environment and expropriation of its natural resource wealth for the benefit of mining companies, core nations, and Indonesian elites, West Papuans have long advocated independence from Indonesia, and some have undertaken a low-level insurgency to achieve this goal (Leith, 2003; Perlez & Bonner, 2005).

West Papuans have also protested and rioted in response to Freeport-McMoRan's mining activities, arguing that they have received little benefit from the mine while bearing the brunt of its environmental costs ("After Clashes, Indonesian Troops Guard Gold Mine," 2006; Perlez, 2006c). Antimine activists are also motivated by the loss of land and subsistence livelihoods that have resulted from mining activities and by the dramatic growth in the area's population brought on by mining, which activists argue has resulted in alcohol abuse, fighting between soldiers and the police, AIDS, and prostitution (Perlez & Bonner, 2005; Walton, 2001).

Freeport-McMoRan and the Indonesian government have responded to antimine protestors and rebels by working closely with each other to suppress these groups and protect the Grasberg mine and other mining activity. For example, after insurgents sabotaged Freeport's copper slurry line in 1977, the Indonesian military "carpet bomb[ed], straf[ed], and reputedly napalm[ed] … surrounding villages" (Leith, 2003, pp. 226–227); and in 1994, "illegal Papuan flag-raising protests" resulted in the closing off of Freeport's mining concession "by the military and … well-documented human rights violations" (Leigh, 2003, p. 227).

In support of the mine, the Indonesian military has also forcefully put down student riots, taken student antimine and pro-independence leaders into custody, and at one point, imposed military rule over the region surrounding the city of Jayapura (Perlez, 2006a). This occurred in 2006 in response to large antimine protests that erupted when Freeport evicted from its property locals who were panning for gold from mine waste (Kearney, 2006). The incident sparked student and pro-independence demonstrations for the next month, as activists demanded that the mine be closed due to its devastating environmental impacts, its lack of benefit to local people, and the human rights abuses the Indonesian military has committed to protect the mine (Kearney, 2006). The protests were brought to a halt when

[13]Other sources estimate that the mine produces 200,000 to 230,000 tons of waste a day.

police clashed with thousands of demonstrating students. During this violent confrontation, police fired randomly into the crowd and students beat three officers to death (Kearney, 2006). The Indonesian military responded by implementing military rule in the region, conducting door-to-door raids, and arresting dozens of protest leaders (Perlez, 2006a).

The Indonesian military also polices and protects the mine itself (Perlez, 2006b) and has been accused of committing rapes, extrajudicial killings, and other human rights abuses in defense of the mine (Perlez & Bonner, 2005). In return, Freeport-McMoRan has spent millions of dollars on the Indonesian military and police. For example, Freeport is known to have given at least $20 million in direct payments to the Indonesian military and police to protect the mine, though some believe the actual figure is much higher, and the company has provided the Indonesian military with $35 million for military infrastructure (Perlez & Bonner, 2005). Finally, Freeport-McMoRan and the Indonesian military recently worked together to spy on environmentalists concerned about the impacts of the Grasberg mine (Perlez & Bonner, 2005).

Copper mining is associated with military activity and armed violence in other locations as well. For instance, Rio Tinto's experiences as a partner in the Grasberg mine are not so different from its experiences at its Panguna copper mine in the now-autonomous region of Bougainville, Papua New Guinea. Although not currently operational, the Panguna mine was once the largest open-pit copper mine in the world, producing tremendous revenue for Rio Tinto and Papua New Guinea. However, as a consequence of mine construction and production, thousands of acres of rainforest were cut down and billions of tons of mine waste were dumped into local rivers and the surrounding ocean, degrading drinking water quality and destroying fisheries and local fishing economies (Klare, 2001; Langston, 2004). Mine pollution may also have increased death rates on the island, especially among children (James, 2006). In addition, villagers living on or near the mine property were forcibly removed from the area to make way for the mine (James, 2006), and thousands of foreign miners were brought to the island, threatening traditional cultures and ways of life (Langston, 2004).

When some Bougainvillians sought to rectify this situation by attacking the mine, closing it, and declaring independence from Papua New Guinea, the Papuan government responded by invading Bougainville (Klare, 2002). Some people believe that the invasion was carried out at the behest of Rio Tinto, which may also have helped transport Papuan troops to Bougainville during the conflict (Langston, 2004). The resulting war left 15,000 to 20,000 dead (Economist, 2008).

The recent history of Ivanhoe Mines Ltd. points again to the relationship between copper mining and armed violence. Ivanhoe began investing in the Monywa copper mine in Myanmar in 1992 and was soon a 50% owner of the mine.[14] Myanmar's military government, which uses slave labor, brutally represses any opposition to its rule, and routinely violates its citizen's human rights, also has a large stake in the mine (Hoffman, 2007; Stueck, 2006). Human rights organizations argue that the infrastructure that surrounds and supports the mine was built by forced labor (Cohn, 2001), and as we argued in the case of manganese mining in Gabon, it is difficult to separate mining activities from armed violence and the threat of armed violence in highly repressive regimes such as Myanmar's, especially when the government is a major mine owner.[15]

[14]Ivanhoe, which is partially owned by Rio Tinto, apparently sold its shares in the Monywa mine to members of the ruling junta in 2009.

## Violence Associated With Other Minerals and Vital Natural Resources

The evidence presented in the case studies and in Table 2 supports our argument that natural resource extraction is often associated with armed violence. It further suggests that armed violence plays a key role in ensuring that natural resources critical to industrial production and national security are extracted and sold in sufficient quantities to promote capital accumulation and state power in the core (state power is, of course, predicated on a strong national economy). Thus, armed violence appears to be a key mechanism that helps make global capital accumulation, core nation state power, the global ecological crisis, and ecological unequal exchange possible.

The case studies also support our theoretical argument about why natural resource extraction is often associated with armed violence. As predicted, in four of the six case studies—Brazil, China, West Papua, and Bougainville—the national government used armed violence to suppress antimine activists or insurgents who were protesting or rebelling against the negative repercussions of mining. In all four of these cases, the negative repercussions included environmental degradation and the loss of livelihoods; in Brazil, West Papua, and Bougainville, they included forced removal; in Brazil, China, and Bougainville, they included health problems associated with or believed to be associated with mining; and in both West Papua and Bougainville, the local residents were indigenous and colonized people who resented foreign rule. Moreover, in the two cases where protest did not occur (Gabon and Myanmar) the governments were so highly repressive as to make protest or media coverage of protest highly unlikely. Finally, as we predicted, forced removal occurred in Brazil, West Papua, and Bougainville to make room for mining or mine-related activities.

Obviously, armed violence is not associated with the extraction of all the critical minerals we examined (or of all natural resources), and it is quite doubtful that the violent actions of the governments and companies examined here were motivated by concern about global or core nation capital accumulation or the military power of wealthy nations.[16] Nevertheless, by increasing the available mineral supply and keeping mines operational, armed violence likely helps to lower mineral prices and increase mining company profits, both of which support global and core nation capital accumulation and state power, the former (low prices) by increasing corporate profits in general and the latter (mining company profits) by ensuring that mining companies are able to stay in business and extract the minerals that industrial economies and modern militaries require.

Of course, it is possible that the critical minerals examined in the case studies and in Table 2 are associated more strongly with armed violence than are other minerals and natural resources. To demonstrate that this is unlikely, this section briefly examines the world's three largest mining companies, African mines that have received World Bank funding or insurance underwriting, and petroleum and rainforest timber extraction and transport, all of which are associated with armed violence.

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[15]Myanmar's human rights violations include the following:
Abridgement of the right to change the government; extrajudicial killings, including custodial deaths; disappearances; rape, torture, and beatings of prisoners and detainees; arbitrary arrest without appeal; politically motivated arrests and detentions; incommunicado detention; infringement on citizens' right to privacy; forcible relocation and confiscation of land and property; restriction of freedom of speech, press, assembly, association and movement; restriction of freedom of religion; discrimination and harassment against Muslims; restrictions on domestic human rights organizations and a failure to cooperate with international human rights organizations; violence and societal discrimination against women; forced recruitment of child soldiers; discrimination against religious and ethnic minorities; trafficking in persons, particularly of women and girls for the purpose of prostitution and as involuntary wives; restrictions on worker rights; [and] forced labor (including against children), chiefly in support of military garrisons and operations in ethnic minority regions. (U.S. Department of State, 2006b)

[16]As noted earlier, these companies and nations are likely concerned about their own profits, power, and survival rather than about global or core nation capital accumulation.

The world's three largest mining companies (in terms of total assets) are Rio Tinto, CVRD/Vale, and BHP Billiton. Rio Tinto, which is a major owner of the Grasberg mine that we previously discussed, also ran the now closed Kelian gold mine in Indonesia. To open this mine, Indonesia forcibly evicted hundreds of indigenous Dayak villagers from their land, and security guards at the mine raped, beat, and shot local community members in order to sow fear and prevent protest (Branford, 2007). In the early 2000s, Rio Tinto also forcibly relocated nearly 1,000 people to make way for its Murowa diamond mine in Zimbabwe (Financial Gazette, 2003); and in 2007, it purchased the aluminum giant Alcan, which made it partners with the highly repressive Guinean government, which has regularly used security forces to violently suppress mine worker strikes and community antimine protests (Africa News, 2007b; BBC, 2008). Rio Tinto also benefited in the 1980s from the violent repression we discussed in Bougainville, Papua New Guinea (Branford, 2007), and in 2006 invested in Ivanhoe Mines, which as previously noted, operated in Myanmar and benefited from that country's repressive military regime (Mines and Communities, 2007).

CVRD/Vale, on the other hand, was the major corporate beneficiary of the violent Carajas Grande Project. In 2006, it also acquired the international mining giant Inco, which mined nickel in Guatemala for nearly 40 years on land expropriated by the authoritarian Guatemalan government from the indigenous Q'eqchi' people (Russel, 2006). The Guatemalan government continues to use military force to keep the Q'eqchi' people from peacefully reoccupying this land. In addition, Inco also operated a nickel mine in New Caledonia, where authorities responded violently to native islanders' protests against the mine, at times firing live ammunition at protesters (MiningWatch, 2006). By acquiring Inco, CVRD/Vale also took possession of its Sulawesi nickel operations in Indonesia. To make way for the Sulawesi mine, the authoritarian Suharto regime forcefully expelled the Karonsi'e Dongi people from the area. The Karonsi'e Dongi have since suffered from widespread environmental degradation and continued human rights abuses (MiningWatch, 2005). Finally, the ongoing development of CVRD/Vale's Moatize coal mine in Mozambique requires the forced removal of more than 1,300 families. Resettlement began in 2010 (Agencia de Informacao, 2010).

BHP Billiton has also relied on armed violence to commence and sustain mining operations. For example, force and violence were used to relocate people from their land in order to make way for BHP Billiton's Tintaya copper mine in Peru and to protect the mine once it became operational (Herald Sun, 2005); and in Colombia, military police forcefully evicted residents of the entire town of Tabaco to construct the world's largest coal mine, the Cerrejon coal mine, of which BHP Billiton is a major shareholder (Roberts & Trounson, 2007). Community activists accuse the mine of continuing to evict other villagers from their land (Roberts & Trounson, 2007), and surrounding villages have suffered brutal attacks and massacres by paramilitary forces, though BHP Billiton denies involvement (Robinson, 2005). BHP Billiton does, however, acknowledge that it contracts with the Colombian military to provide protection to its employees and property (Robinson, 2005).

Many World Bank–supported mines are also associated with armed violence, including the Ghanaian/Australian and Ahafo gold mines in Ghana, the Kalahari diamond mine in Botswana, the Konkola copper mine in Zambia, the Kolwezi cobalt and copper tailings project and Anvil copper and silver mine in the Democratic Republic of Congo, the Magadi soda ash mine in Kenya, the Bulyanhulu gold mine in Tanzania, the Kasese cobalt mine in Uganda, the Sadiola gold mine in Mali, the Essakane gold mine in Burkina Faso, and the Kenare Moma titanium and zircon mine in Mozambique. Violence at these mines includes beatings, torture, arbitrary arrests, forced removal, shootings, and warfare (ongoing research being conducted by the authors of this article).

Logging is also often associated with violence. Although much of this violence involves conflict between illegal loggers and indigenous people (New York Times, 2007), state- and company-sponsored armed violence play a critical role in facilitating hardwood extraction in several nations, including Malaysia (Meo, 2007), Indonesia (Allard, 2005; Poulgrain, 2005), Myanmar (MacKinnon, 2007), Liberia (from 1989 to 2003; Bloomfield, 2006), and the Democratic Republic of Congo (Vidal, 2007). Armed violence has also played an important role in enabling the clear-cutting of forests in Indonesia to make way for palm oil plantations designed to produce biodiesel (Green, 2007; Knudson, 2009). Violent actions associated with hardwood extraction and clearing forests for palm oil plantations include arrests, armed protection of loggers by soldiers, soldiers beating protestors, rape, murder, the wholesale demolition of villages, and forced relocation.

Military violence and military aid also play a critical role in facilitating petroleum extraction and transport and in allowing the United States to maintain control over petroleum supplies (Klare, 2004). For example, the United States is currently engaged in two wars that are directly (Iraq) and indirectly (Afghanistan) related to petroleum production or transport,[17] and in the 1980s, the U.S. navy protected Kuwaiti oil shipments through the Strait of Hormuz (Klare, 2004). The United States also provides military training and high levels of military aid to nations that either possess large oil reserves or, like Israel and Egypt, are located in regions with large oil reserves.[18] In addition, the U.S. military command structure, including its new African Command (Africom), is designed in large part to protect and secure oil and mineral supplies (Berschinski, 2007).

We thus feel fairly confident in stating that the use of armed violence to safeguard resource extraction and transport activities is not restricted solely to the critical minerals that form the heart of our investigation.

## Conclusion

The evidence presented in this article clearly demonstrates that armed violence is associated with the extraction of many critical and noncritical natural resources, suggesting quite strongly that the natural resource base upon which industrial societies stand is constructed in large part through the use and threatened use of armed violence. The evidence also demonstrates that when armed violence is used to protect resource extraction activities, it is often employed in response to popular protest or rebellion against these activities. These findings, and the theoretical model set forth in this article, extend prior sociological thinking and research on the environment in several important ways. First, as we previously noted, very few environmental sociologists have examined armed violence and militarism, and those that have done so have generally restricted their attention to the direct environmental consequences of weapons production, military activity, and war. Thus, this article establishes more clearly than prior environmental sociology research the degree to which armed violence underpins the current ecological crisis.

Second, in identifying armed violence as an important mechanism promoting ecological unequal exchange, and theorizing that armed violence works in concert with other institutional, organizational, ideological, legal, and technological mechanisms to ensure core nation access to and control over vital natural resources, this study contributes to the literature on ecological unequal exchange, which has focused more attention on establishing

[17]Afghanistan has long been considered a potential site for a pipeline to transport oil to Western nations. It also apparently contains more than $1 billion in unmined minerals.

[18]For example, in 2007, the United States provided Israel with $2.34 billion in military aid and Egypt with $1.3 billion in military aid; and in the 2-year period from 2006 to 2007, the United States provided Saudi Arabia with $2.5 billion in military equipment transfers.

the existence of ecological unequal exchange than on identifying the mechanisms responsible for it.

Third, this article helps demonstrate that much of the armed violence associated with natural resource extraction is carried out by developing nation governments, mercenaries, and rebels. It also offers a theoretical argument for why developing nations are likely to use armed violence to achieve their resource extraction goals even when doing so promotes ecological unequal exchange and the continued domination of these nations by core nations.[19] Thus, this article (a) provides a rationale for why developing nation governments sometimes use armed violence to achieve resource extraction goals that contradict their long term interests and (b) suggests that core nations and corporations are able to distance themselves from many violent actions that benefit them, actions that they might otherwise have to take themselves.

The ability of core nations and corporations to distance themselves from extraction-related violence is potentially important because it likely allows these nations and corporations to divert blame for this violence (and the human rights abuses associated with it) away from themselves and to present their control over natural resources as the legitimate product of a just and rational world market. As a result, extraction-related armed violence carried out by developing nations may often help to legitimate core nations, core nation corporations, international trade and finance institutions, and the global economic order by stigmatizing developing nations and disassociating core nations, core nation corporations, and the institutions they control from the violent underpinnings of the global extractive industry.[20]

Clearly, more work needs to be done to fully substantiate these claims as well as many of the theoretical claims we make in the article. Nevertheless, as we state in the introduction, our goal in this article was not to empirically examine all of our theoretical claims. Instead, our goal was fourfold: to develop a new theoretical argument that links natural resource extraction, raw material transport, and environmental degradation to armed violence; to demonstrate that this link is theoretically and substantively important; to begin filling in the gaps in the ecological unequal exchange and environmental sociology literatures that we identified in our literature review; and to demonstrate that armed violence plays a critical role in facilitating natural resource extraction, without which ecological unequal exchange could not occur and much environmental degradation would not occur. We have, therefore, achieved the goals we set for ourselves at the beginning of the article.

More importantly, when one combines the evidence presented in this article with prior sociological research on ecological unequal exchange and the direct environmental consequences of armed violence, militarism, and war, it quickly becomes apparent that armed violence and the environmental degradation associated with it are intimately woven into the everyday lives of core nation citizens through the purchases they make and the fuels they consume.[21] It also becomes apparent that armed violence is a key driver of the global ecological crisis and that this is likely the case because other key drivers of natural resource exploitation, such as the IMF, World Bank, WTO, and global marketplace, cannot, on their own, guarantee core nation access to and control over vital natural resources.

[19]Although it is true that developing nation elites often benefit immensely from the sale of their nations' natural resources, they are still junior partners in their relationships with core nations and foreign corporations. It is thus reasonable to think that they would behave differently, if not necessarily in their citizen's or the environment's best interests, if they had more power.

[20]The importance that this type of "disassociation" plays in legitimizing core nation and corporate activities is highlighted by the difficulties the diamond industry faced when the violence associated with diamond mining became highly publicized. It was also highlighted by the Bush administration's repeated attempts to convince U.S. citizens that its war in Iraq was not about oil.

[21]This is true regardless of whether core nation citizens are aware of or in any way responsible for this violence.

This, of course, suggests that armed violence is a serious environmental problem regardless of whether, in any specific instance, it is used, threatened, or merely implied. It also suggests that environmentalists and environmental sociologists have to examine and address armed violence and other resource extraction mechanisms simultaneously and in concert with other macro- and micro-level drivers of ecological degradation if they are to fully understand and solve the global ecological crisis. In addition, because the effective use of armed violence is predicated on the existence of inequality and power differences between social groups and/or nations, it further suggests that inequality and power are key drivers of environmental degradation. This claim is, of course, consistent with much environmental sociology research. Finally, it suggests that the IMF, World Bank, WTO, and global marketplace are violent institutions not just in their effects but also because they require the use and threatened use of armed violence (by others) to achieve their resource extraction and related capital accumulation goals. This has important implications not only for environmental sociology but also for the study of globalization, markets, and the international trade and finance institutions that undergird the global economy.

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## Biographies

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## Table 1

Critical Mineral End Uses, Production, and Reserves

| Mineral | Use With Highest Impact Score | % World Production | % World Reserves |
|---|---|---|---|
| Platinum | Autocatalysts for motor vehicle emissions control, industrial, and other | South Africa (77%), Russia (13%), Canada (4%), Zimbabwe (2%), United States (2%) | Total platinum group metal reserves: South Africa (89%), Russia (8%), United States (1%), Other (2%) |
| Palladium | Autocatalysts for motor vehicle emissions control, industrial, and other | Russia (44%), South Africa (38%), United States (6%), Canada (6%), Zimbabwe (3%) | See platinum |
| Rhodium | Autocatalysts for motor vehicle emissions control, industrial, and other | South Africa (89%), Russia (7%), North America (2%), Other (2%) | See platinum |
| Rare earth elements | Emissions controls, magnets, and electronics | China (76%), France (9%), Japan (4%), Russia (3%), other (8%) | China (31%), Commonwealth of Independent States (22%), United States (15%), Australia (6%), India (1%) |
| Manganese | Steel and cast iron | South Africa (19%), Australia (18%), China (13%), Brazil (12%), Gabon (11%) | Ukraine (30%), South Africa (22%), Australia (13%), India (12%), China (9%) |
| Indium | Coatings (flat-panel displays, etc.) | China (60%), Japan (9%), South Korea (9%), Canada (9%), Belgium (5%) | China (73%), Peru (3%), United States (3%), Other (11%) |
| Niobium | Superalloys (for the aerospace industry, etc.) | Brazil (90%), Canada (9%) | Brazil (96%), Canada (2%), Australia (2%) |
| Vanadium | Nonsteel alloys | South Africa (39%), Canada (31%), Russia (27%) | China (38%), Russia (38%), South Africa (23%) |
| Titanium | Aerospace, high technology | Australia (27%), South Africa (20%), Canada (14%), China (9%), Ukraine (6%) | China (27%), Australia (20%), India (13%), South Africa (10%), Brazil (6%) |
| Copper | Energy provisioning, power production | Chile (35%), United States (8%), Peru (7%), China (6%), Australia (6%) | Chile (31%), United States (7%), Indonesia (7%), Peru (6%), Mexico (6%), Poland (6%) |

**Table 2**

Critical Minerals and Violence

| Mineral | Military/ Police/ Mercenary Actions Against Protestors | Military/Police/Mercenary Security of Mines | Repressive Regimes | Repress Indigenous or Colonized Peoples | Forced Removal | Forced/Prison Labor | Other Violence |
|---|---|---|---|---|---|---|---|
| Platinum group | South Africa | | Soviet Union/Russia (4.1)<br>South Africa (3.3) | | South Africa | Soviet Union | Russia (area closed to outsiders; journalists need permission to enter) |
| Rare Earth Elements | Malaysia | | China (Inner Mongolia) (4.2)<br>Russia (4.1)<br>India (3.6) | China (Inner Mongolia) | | | Malaysia (1987: Activist held in solitary confinement for up to 2 months, where he was interrogated and at one point kept awake for 78 hours) |
| Manganese | China<br>Brazil (see other violence) | | China (4.2)<br>Brazil (3.9)<br>Gabon (no data, see Note 9)<br>South Africa (3.3)<br>India (3.6) | | Brazil (as part of a railway project designed to gain access to the region's minerals) | | Brazil (protesters were beaten, threatened, and sometimes tortured and killed)<br>China (hired thugs beat protestors; in one town all men older than16 years of age were held for interrogation) |
| Indium | Tibet | | China (Tibet) (4.2) | China (Tibet) | | | |
| Niobium | | | Brazil (3.9) | Brazil | Brazil (as part of a larger state project to secure the border, fight drug trafficking, and facilitate resource extraction) | | |
| Vanadium | | | China (4.2)<br>Russia (4.1)<br>South Africa (3.3) | | | | |
| Titanium | Sierra Leone | Sierra Leone (mercenaries) | China (4.2)<br>India (3.6)<br>South Africa (3.3)<br>Brazil (3.9) | | Sierra Leone<br>Kenya<br>South Africa (potential) | | Kenya (when lawyers tried to inform farmers of their rights regarding forced relocation, police told them to stop or they would be arrested)<br>India (government was prepared to appropriate 10,000 acres of land for mining until protesters convinced the |

| Mineral | Military/ Police/ Mercenary Actions Against Protestors | Military/Police/Mercenary Security of Mines | Repressive Regimes | Repress Indigenous or Colonized Peoples | Forced Removal | Forced/Prison Labor | Other Violence |
|---|---|---|---|---|---|---|---|
| | | | | | | | government to put the mining project on hold) |
| Copper | Indonesia (West Papua) Papua New Guinea (war) | Indonesia (West Papua: The mine has paid the military and police for protection and provided the state with military infrastructure) | Indonesia (West Papua) (3.7) Papua New Guinea (3.5) Myanmar (4.1) Philippines (3.7) Mexico (3.2) | Indonesia (West Papua) Papua New Guinea (war) | | Myanmar | Indonesia (West Papua kept off-limits to outsiders; military personnel have been accused of rapes, killings, and other abuses in defense of the mine; spying on environmentalists) |

Note: The numbers in parentheses are ten year averages of each nation's Political Terror Scale scores