Disputed territories

Mineral extraction for energy transition aggravates land possession and water access conflicts in Brazil

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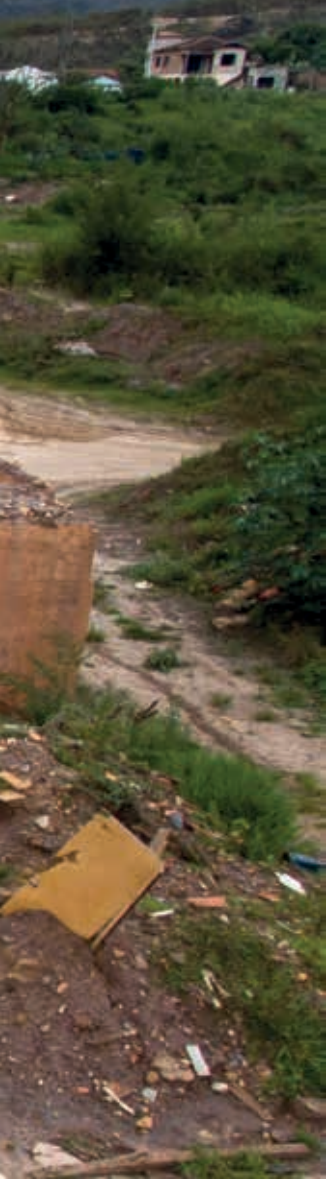
The race for the exploration of minerals that have been dubbed critical for the energy transition is exacerbating existing socioenvironmental conflicts in the Brazilian mining and metals sector. These natural elements are needed to develop a low-carbon economy and to produce components used in the manufacture of batteries, electric vehicles, solar panels, wind turbines, and others. They are also largely used in activities not related to the energy transition. A total of 101,000 people across 15 states were impacted by transition mineral extraction, which led to 380 confrontations in the country between 2020 and 2023. The Amazonia Legal region, a collective of nine Brazilian states, had the most disputes, with 46.3% of incidents. Individual analysis by state revealed that Pará and Minas Gerais accounted for 66.7% of the clashes. The data were collated in a study published in August by the Observatory of Mining Conflicts in Brazil, an initiative by



Bento Rodrigues, in the Mariana region (MG), in 2016: the subdistrict was badly affected by the Samarco dam collapse

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researchers from institutions across the country, social movements, and nongovernment organizations (NGOs).

Another survey conducted by the same observatory in 2023 indicated that since 2020, legal and illegal extraction throughout the mineral sector has led to between 850 and 950 conflicts and affected approximately 1 million people per year. The document also shows that in 2022, the states of Minas Gerais (37.5%), Pará (12%), and Alagoas (10.1%) reported the highest proportion of people affected by the disputes.

One of the research authors, geographer Luiz Jardim Wanderley of Fluminense Federal University (UFF), stated that conflicts are considered the reactions of those affected by social and environmental impacts and by situations of violence, including working under slave-like conditions, rapes, accidents, threats, attempted murders, and deaths. Wanderley states, "During the pandemic, the mineral sector registered countless labor violations for not having adopted efficient policies to safeguard the health of workers". The "Annual Report of the International Council on Mining and Metals" indicates that in Brazil, 43 employees of companies associated with the entity died as a result of workplace accidents in 2021. The figures for 2019 and 2020 were 287 and 44, respectively.

Wanderley explains that to be included in the mapping, the conflict must have given rise to reactions among the population, including legal proceedings, protests, letters of repudiation, or grievances published in newspapers. He specifies that "Confrontations not causing this type of response are not counted in our figures". In the survey studies, data from the Pastoral Land Commission (CPT), which has been recording agrarian conflicts since 1985, and the Indigenist Missionary Council (CIMI), both entities of the Catholic Church, were analyzed. Data on this type of incident that were recorded in documents produced by NGOs, grievances manifested by social movements, press news, and other means were also used.

The study of minerals needed for energy transition covered conflicts involving 31 elements, including aluminum, barium, boron, cadmium, cobalt, copper, lithium, manganese, niobium, and nickel. According to information from the Brazilian National Mining Agency (ANM), the extraction value of these minerals between 2013 and 2022 rose from R$27.7 billion to R$38.6 billion, resulting in real-term (inflation-deducted) growth of 39%. In the same period, the mineral sector numbers as a whole increased from R$243 billion to R$266 billion in deflated values—a 9.3% rise.

The conflicts that have been identified in this survey may overlap: the most prevalent type covers land-use disputes, which are involved in 59.2% of incidents, followed by conflicts over water access (39.4%), health issues (16.4%) and labor disputes (12.4%), which explains Wanderley. Energy transition minerals copper and bauxite were the most significant causes, accounting for 25.3% of the incidents each. Moreover, the market value of these elements escalated between 2020 and 2023. "The data suggest that there is a correlation between the intensity of mineral extraction, its sale value, and the incidence of conflicts," he says.

Barcarena (PA), Canaã dos Carajás (PA), and Craíbas (AL) occupy the top three spots on the list of towns and cities with the highest number of disputes involving the mining of important elements for the energy transition. "The overall trend is a rise in per capita revenues across municipalities hosting mining activity. However, social development and a reduction in inequalities have not gone hand-in-hand with these increases," says João Marcio Palheta of the Federal University of Pará (UFPA), who did not participate in the study.

Predominant in Barcarena is the extraction and processing of bauxite, which is used in the production of aluminum. In 2018, local people complained of tailings (mining waste) leaking from a dam, which contaminated rivers and igarapés (tropical creeks). The primary mining activity in Canaã dos Carajás is iron and copper ore extraction, which has displaced local communities. "This situation generates conflicts over land losses and impacts lifestyles among communities, primarily indigenous and riverside dwellers," says Palheta. The municipality is also a focal point for labor disputes with mining companies; the region is home to the largest iron-ore extraction projects in the history of Brazilian-founded multinational giant Vale, with an output capacity of 120 million tons per year.

Palheta studies four municipalities hosting mining projects in Pará State: Barcarena, Parauapebas, and Paragominas, as well as Canaã dos Carajás. He states that the municipalities with the highest per capita gross domestic product (GDP) in Brazil frequently cover locations with large-scale industrial or extractive projects, such as those in Parauapebas. Palheta reports, "Nevertheless, as occurs across other towns and cities with these characteristics, Parauapebas is blighted by poverty and lacks basic sanitation".

He believes this to be due to a lack of transparency in the use of funds from the Financial Compensation for Mineral Exploration (CFEM),

which is levied on mining profits. "CFEM resources can only be invested in healthcare and education, but there is a lack of control mechanisms to identify where the money is in fact spent," states the geographer. On the basis of reports published by the Observatory of Mining Conflicts in Brazil, the Municipal Human Development Index (IDH-M) falls short of the national average in 27 of the 50 municipal areas most mined in Brazil. With respect to the Gini index, which measures inequalities, 34 of these 50 municipalities have worse indicators than the world's 14th most unequal country, the Republic of the Congo.

According to the organization, the groups that are most affected by energy-transition mineral exploration are small rural landowners (involved in 23.9% of occurrences), mining company workers (12.1%), and indigenous peoples (9.8%), whereas international mining corporations (46.3%) and medium-sized national companies (33.6%) predominated among organizations implicated in conflicts. "The rising value of energy-transition minerals increasingly attracts smaller mining operations to locations with little background of mining exploration, further complicating the situation," says UFF's Wanderley.

His observation is backed by economist Beatriz Macchione Saes of the Federal University of São Paulo (UNIFESP). On the basis of research into the relationships among economic development, mining, and conflicts triggered by the activity, she provides an example of the situation in the Jequitinhonha Valley, Minas Gerais State. Since 1991, the region has received projects for the exploration of lithium, a metal used, among other applications, in electric car batteries; however, an increasing number of mining companies are interested in taking action. She notes, "Four companies are currently seeking approval for lithium exploration initiatives in the region, and their possible installation may worsen conflicts with local communities".

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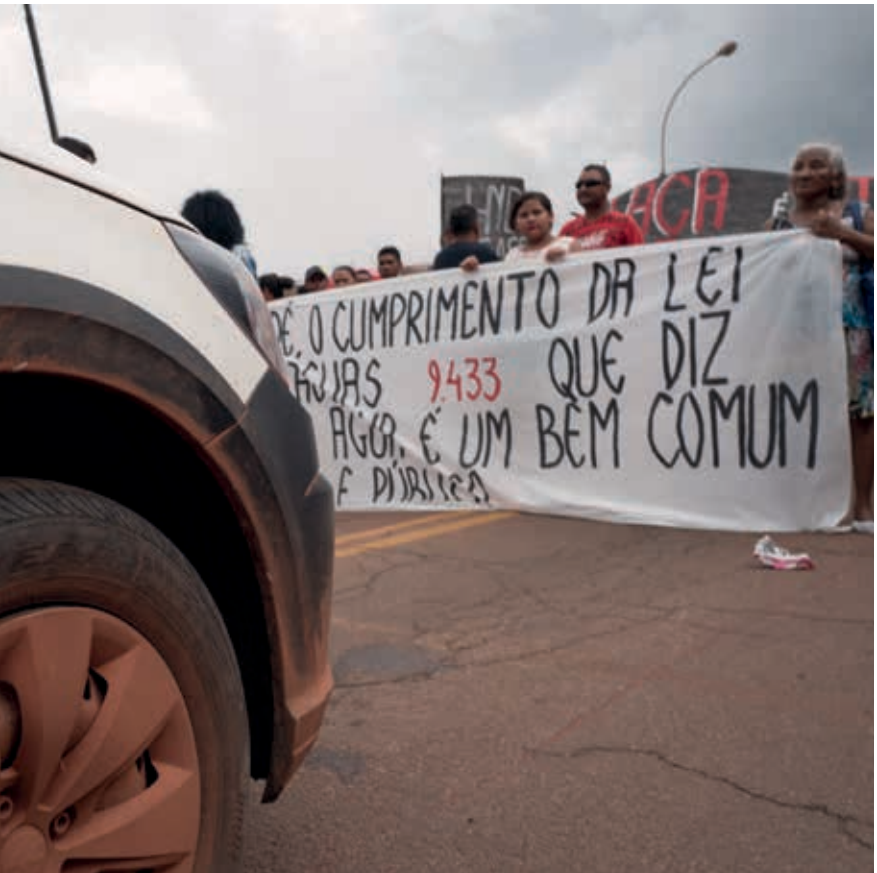

Residents of Barcarena (PA) protesting in 2018 against process waste discharge into the local river by an aluminum refinery

The production engineer Bruno Milanez of the Federal University of Juiz de Fora (UFJF) and a specialist in mineral sector corporations explained that after the 1990s, these companies began to adopt practices to mitigate socioenvironmental impacts. The researcher provides the example that, up to 1989, mining companies operating in Oriximiná, state of Pará, discharged their extraction waste directly into the rivers in a procedure accepted in those days by the Brazilian State. He notes, "Those companies are still trying to remedy the damage resulting from this activity to the present day". In the 2000s, mining corporations installed dams to contain tailings; these days, this waste can be dry-stacked after passing through filtration systems. "However, even with reduced impacts, the negative socioenvironmental effects cannot be escaped," he states. Milanez reports that some companies recognize the issue and no longer use the term 'sustainable mining,' noting that "the most common concept currently used by the sector is 'responsible mining.' Companies acknowledge that negative impacts are inherent in their activities, but maintain that damage reduction strategies can be adopted".

In a statement issued by email, the aluminum multinational Hydro Group noted that operations carried out by companies receiving their investments in the country are monitored and audited, with the commitment "to being good neighbors to communities." One of these operations is Mineração Paragominas in Pará, which has adopted a technique for returning inert bauxite mining tailings to brownfield areas. The company states that this method enables reconstruction of the original land topography and reduction of erosion risk, minimizing environmental impacts. Multinational Anglo American, which extracts diamonds, mercury, copper, and nickel, explained via email that, in 2019, it created a plan to improve education and health care systems among host communities in Brazil.

Saes, of UNIFESP, says that the commodity boom between 2020 and 2014 was marked by a worsening of the incidence of this type of con-

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A copper mine in Canaã dos Carajás (PA), one of the municipalities with the highest number of conflicts associated with energy-transition minerals

PHOTOS 1 ALESSANDRO FALCO/BLOOMBERG VIA GETTY IMAGES **2** NELSON ALMEIDA/AFP VIA GETTY IMAGES

flict in the country. During that period, Brazil recorded a considerable increase in the demand for primary goods and raw materials, including minerals. "Iron ore was one of the most in-demand commodities in the international market, with exports soaring from 100 million tons in 2000 to 300 million tons in 2015," she adds, going on to say that the rise in conflicts is proportional to the expansion of mining activities.

In the first decades of the twenty-first century, two of Brazil's largest environmental disasters, caused by iron ore extraction, took place. In 2015, a dam collapse at the mining complex of Samarco (controlled by Vale and Anglo-Australian giant BHP Billiton) in the region of Mariana (MG) killed 19 people and spilled 39 million m³ of toxic sludge, affecting the Doce River and several communities across the states of Minas Gerais and Espírito Santo over more than 600 kilometers (km). According to the Atlas of the Brazilian mineral problem (*Atlas do problema mineral brasileiro*), published in 2023, the triumvirate formed by Samarco, Vale, and BHP Billiton was responsible for the greatest number of conflicts between 2004 and 2020, with a total of 462 conflicts occurring during that period.

In 2019, the collapse of a Vale dam in Brumadinho (MG) killed 270 people and contaminated the Paraopeba River basin, which is 510 km long. In an emailed communication, Vale stated that R$37.7 billion was earmarked for remediation of the damage caused by the disaster, with 70% of this total applied to date. The company further states that mechanisms have been in place since 2023 to hear about the needs of affected populations.

In Mariana, the reparation process undertaken by Samarco allocated R$37 billion for reparation and compensation of damage arising from the disaster, of which R$17.48 billion has been paid out in indemnities and emergency financial aid. In a statement sent by email, the company affirmed that the resettlement of impacted communities was 85% complete. Despite these agreements, victims are seeking recourse under the UK legal system, as BHP, one of Samarco's controllers, is Anglo-Australian in origin. In 2023, a London law firm filed a damage indemnity claim to the value of R$230 billion for 700,000 victims of the disaster.

A researcher examining the development of these reparation efforts, sociologist Raquel Oliveira, of the Study Group into Environmental Matters at the Federal University of Minas Gerais (UFMG), notes that the process has led to inter-

nal tensions between the affected communities. Oliveira explained that prior to the disaster, many families shared their lands with their relatives. Grandparents, parents, and children, for example, would build their houses on the same smallholding, maintained as inheritance land. She adds, "Nonetheless, these reparation measures do not fully take into account the complexity and dynamics of these land arrangements, leading to revision of domestic agreements and hampering the recognition of new family units".

Anthropologist Gabriela de Paula Marcurio, who is conducting doctoral research at UNIFESP with a fellowship from FAPESP, highlights another issue—the mining companies implicated in these disasters not considering relevant losses by the afflicted communities when they cataloged the harm caused by their activities: forced changes in lifestyle and the time spent managing problems caused by the dam collapse, such as attending meetings. As part of her doctoral work, Marcurio is researching the influx of companies looking to exploit iron ore, copper, and phosphate from the region of Juazeiro, in the *sertão* (badlands) of Bahia State, an area in which the mineral frontier is expanding. She states that the people of the area start to feel the effects even before the formal installation of a mining company. "Small-scale farmers have complained about the presence of drones, and outsiders walking around their properties without consulting them," she says.

Milanez, of the UFJF, emphasizes that the Brazilian subsoil is a federal government asset; thus, people's houses may be expropriated to enable projects in the sector to progress. Furthermore, according to ANM, those who obtain authorization to install a mine in a certain location will hold exclusive rights to exploit the land in question. This engineer states that "In many instances, these factors will put conflicts in a situation characterized by an imbalance of power".

With an end to articulating and disseminating strategies to constrain or prohibit mining in certain areas, a group of researchers, social movements, local communities, and NGOs created the platform *Territórios Livres de Mineração – TLM* (Mining-Free Lands) in 2022. This repository carries information on steps taken in line with municipal legislation, plebiscites, and public consultations that were successful in putting the brakes on undesirable projects in vulnerable areas, exemplified by the town of Muriaé (MG), whose residents thwarted the installation of a bauxite exploration project in the district of Belisário in the surrounding area of Serra do Brigadeiro State Park. "Public pressure caused local councilors to approve of Law Bill 192, classifying the region as water heritage, and impeding mining activity in the location," Milanez concludes. ●

The project, scientific articles, reports, and book consulted for this report are listed in the online version.

Photo from 2019 showing the destruction caused by the Vale dam collapse in Brumadinho (MG)

PHOTO VICTOR MORIYAMA/BLOOMBERG VIA GETTY IMAGES