

Rio Doce: Risks and Uncertainties of the Mariana Disaster (MG)

Rio Doce: riscos e incertezas a partir do desastre de Mariana (MG)

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RESUMO

Na Bacia Hidrográfica do Rio Doce, no Sudeste brasileiro, município de Mariana (MG), o rompimento da barragem de Fundão, em 5 de novembro de 2015, desencadeou o desastre da Samarco/Vale/BHP. O desastre não foi uma ocorrência natural, pois resultou da adoção de tecnologias e decisões técnico-administrativas, cujas responsabilidades criminais foram apontadas pelo Ministério Público. Os impactos foram diretos e indiretos sobre rios e terrenos aluviais; sobre as áreas de proteção ambiental, reservas florestais, flora e fauna; sobre os *habitats*, hábitos e os coabitantes rurais e urbanos; e sobre a zona costeira no estado do Espírito Santo. O artigo busca identificar a problemática que emerge do desastre,

ABSTRACT

In the Brazilian Southeast, in the basin of the Doce River, the municipality of Mariana (MG), the rupture of the Fundação mineral tailings dam on November 5, 2015, triggered the so-called Samarco/Vale/BHP disaster. This was not a natural event but the outcome of adopting particular technologies and technical-administrative decisions. Criminal responsibilities for the disaster were identified by the Public Prosecutor's Office. There were both direct and indirect impacts on rivers and alluvial lowlands, environmental protection areas, forest reserves, flora and fauna. The incident affected rural and urban habitats, habits and cohabitants. Its harmful effects reached the Atlantic coastal region of Espírito Santo state. This article aims to identify the

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discutir as consequências do sentimento de incerteza e analisar a pertinência do desastre como objeto de investigação, sem desconsiderar o papel da mídia na sua construção como evento.

Palavras-chave: desastre da Samarco/Vale/BHP; rio Doce; incerteza.

problems that emerged from the disaster, discuss the consequences of the feelings of uncertainty, and analyse the pertinence of the disaster as a research issue, while also paying attention to the media's role in its social construction as an event.

Keywords: Samarco/Vale/BHP disaster; Doce River (Southeast Brazil); feeling of uncertainty.

THE SAMARCO/VALE/BHP DISASTER: A FIELD OF STUDY OF A SOCIOENVIRONMENTAL DISASTER

The rupture of the Fundão dam on November 5, 2015, in the municipality of Mariana (MG), focused attention on the Doce River and Samarco Mineração S.A., owned by two global mining corporations: the Brazilian Vale S.A. and the Anglo-Australian BHP Billiton. Referring to the rupture and the events that subsequently unfolded in the Doce River Drainage Basin as the 'Samarco/Vale/BHP disaster' not only makes clear the immediate authorship but also the technical and administrative coauthorship and corporate governance of the three companies (Poemas, 2015). The term disaster is not limited to the rupture itself, but also includes the succession of events that have occurred over time and have proven to be persistent in terms of the direct and indirect negative effects on the habitats, habits and coinhabitants of rural and urban areas, rivers, forest reserves and environmental protection areas, including human beings, flora and fauna, as well as the coastal zone of Espírito Santo state.

Considering the spillage of millions of cubic metres of mining waste in the river system, which were channelled by the Doce River – the system's main river – and dumped in the sea, this work has three objectives: 1) establish a guideline for the study of socioenvironmental disasters linked to industrial mining; 2) introduce the category 'uncertainty' as a key tool in the comprehension of the disasters that affect river systems; and 3) show the relevance of socioenvironmental disasters as an object, based on an evaluation of the approach made by the media.

Setting out from the observation that the rupture of the Fundão dam is not an isolated event, the initial aim was to establish a theoretical-methodological guideline for studies of disasters that spread via river systems, affecting human and non-human habitats, habits and coinhabitants. Next, after

differentiating the areas affected (the Upper, Middle and Lower Doce River), the different impacts were identified, observing that the disaster led to an emerging awareness that industrial mining poses a great risk. Thus, the aim was to ascertain the operationalization of the category ‘uncertainty’ in the case of the disaster that struck the Doce River basin. Third, the behaviour of the media was examined, the type of storyline developed, the number of media reports, and the differences and similarities with the studies undertaken by Gregory Button in *Disaster Culture* (Button, 2010), foregrounding the relevance of the disaster as a research topic. Finally, the article points to gaps in the existing research, and emphasizes various notions that should be considered in any future studies, including ethical in nature.

The rupture of the Fundão dam was not an exceptional event. In August 2014, the ‘Mount Polley mine disaster’ had occurred in British Columbia (Canada), caused by the catastrophic failure of the mine tailings dam owned by Imperial Metals Corporation (Marshall, 2018). Thirty years previously, in the Trento province of Italy, on July 19, 1985, the mine tailings dam owned by Prealpi Mineraria had also ruptured, causing the death of 268 people and the devastation of the Rio di Stava valley, where the settlement destroyed by the mud waste was situated. In this disaster the drainage system stopped working, but water continued to be pumped into the dam, leading to liquefaction of its base until the dam eventually failed (Tosatti, 2007). In both cases, the investigations observed that the companies operated with a very small safety margin, or put otherwise, with high levels of stress placed on the structures.

The environmental history of rivers needs to consider the importance of studying disasters in mining complexes, since water is a necessary component to the very functioning of this economic activity. The disasters mentioned here affected first of all the rivers, while their subsequent impacts extended along their channels over large distances, damaging not only human habitats, habits and inhabitants but also non-human habitats, habits and inhabitants. Beyond the river, the river basin needs to be considered as the analysis’s scale of reference. Here a pertinent observation is made by the Independent Panel of the Doce River, coordinated by the International Union for Conservation of Nature (IUCN), created with the objective of exercising “a critical role of advising on recuperation efforts after the disaster and assisting in how to avoid future catastrophes.” In its first report (Sánchez et al., 2018, p. 16 and 18) advises to adopt “a landscape perspective” and consider as the unit of analysis the “river basin and coastal zone.” In this sense, it recommends spanning “the entire scale of the river basin and the terrestrial/marine landscape,” without

which the efforts of reparation and restoration will be neither sustainable or resilient.

Here it is worth introducing some theoretical-methodological guidelines of assistance to an environmental history of the disasters that affect river basins. The observation and analysis of the disasters demand an integrated approach and the use of distinct scales (Racine; Raffestin; Ruffy, 1983; Santos, 1988), as well as the consideration of the spatial differentiation (Santos, 1996). Management of the scale tool enables observation of the localized habitat (biotope or ecotope – for example; small communities of fishermen or family farmers), passing through the river basin and the national habitat, until reaching the global dimension of the phenomenon. At one extreme, the aim is to zoom in sufficiently to ascertain at the smallest unit of observation possible the impacts on abiotic, biotic and cultural dimensions (the habitat and habit of each human and non-human community);² at the other, zoom out sufficiently to encompass the global connections that condition mining activity and are associated with the increased risk of disasters occurring.

The concepts of risk and uncertainty are fundamental and directly linked to the discussion on the impacts of anthropic actions in the environment, the global environmental crisis and the occurrences of disasters with their repercussions (Beck, 2010; Button, 2010; Giddens, 1998; Wynne, 2002; Wisner; Gaillard; Kelman, 2012; Ferreira; Viola, 1996). Beyond the socioeconomic, socioenvironmental, legal and technical dimensions, an integrated approach must also include cultural and subjective dimensions, effectively listen to those affected – principally more vulnerable and less resilient people and groups – and include other non-human coinhabitants.

As well as these observations, five guidelines favour the development of a critical, integrated and interdisciplinary approach: 1) a history of disasters exists; 2) the origin and consequences of mining disasters cannot be disassociated from historical and geographical circumstances; 3) mining disasters are relational problematics marked by power; 4) mining disasters affect the landscape, impacting different human, biotic and abiotic dimensions, with multiple repercussions on habitats, habits and coinhabitants; 5) the tensions that emerge from disasters express different codes and narratives, depending on whether actors are those affected, causers, mediators or assistants in the different sociopolitical, economy, technical-scientific, sociocultural and subjective spheres.

In the Samarco/Vale/BHP disaster, the ecosystems and communities of the upper Doce River were more heavily affected, particularly those localized

along the water courses directly devastated by the slurry that leaked from the Fundão dam. When the mud reached the channel of the Doce River, even after much of the material had been retained by the Risoleta Neves Hydroelectric Dam (Candonga), the impacts were direct and violent on the aquatic and alluvial ecosystems, and, in different degrees, on the species dependent on the river, including rivershore human populations. In general, along the entire channel of the Doce River as far as the sea, all the people and species that depend on the river and the coastal waters had their lives directly and/or indirectly affected in different intensities.

The rupture of the Fundão dam is the tip of an iceberg of the risks associated with the major investments of capital in the mining sector in Minas Gerais. The disaster consummated the growing risk that accumulated during the cycle of high prices of iron ore on the global market between 2005 and 2013, and was accentuated, principally, by the violent fall (almost 70%) experienced at the height of the crisis in the world economy (2008-2009). This risk was explicitly identified in a document of the Public Prosecutor's Office of Minas Gerais state in October 2013.³

The Samarco/Vale/BHP disaster is a socioenvironmental disaster insofar as it stems from the disruption of a sociotechnical-natural system – that is, a system containing technical structures and components created by humans with the purpose of natural structures and components rearranged and altered in order to compose the process of production and circulation to meet economic aims. Water plays an important role in the operation of every mining complex. In the case of the rupture of the Fundão dam, water was the crucial element. At the same time, the rivers, as well as being completely impacted, served as vectors spreading the effects of the disaster. Slurry from the rupture of the tailings dam reached the Santarém dam (a water reservoir), liquefying the waste, which gained velocity and flowed down the courses of the tributary rivers until reaching the Doce River. This triggered diverse events of varied durations and rhythms, spanning from the events that immediately succeeded the collapse of the dams, followed by the days during which the mud waste advanced down the Doce River and into the sea, then the repercussions over the weeks that followed when the at least apparent normality of everyday life had still not been re-established, until the present (3 years later) when diverse repercussions of the disaster can still be observed unfolding with various levels of conflict and with the succession of new events.

Not only in terms of space but also time, unequal scales and durations need to be considered, since the events present rhythms and pass from short

duration (death, destruction, calamities, paralysation of activities, unemployment, time of life of a specimen, and so on) to long duration (alterations for future generations due to the impossibility of repairing and restoring the ecosystemic, socioeconomic and cultural conditions). From the outset there are different times, which range from the geological (availability of raw materials of interest as resources to the possibilities of seismic tremors)⁴ to the immediate management decisions that ignore technical aspects of dam safety, work safety, environmental safety (Rodrigues Junior, 2012) and human safety (Carmo; Valencio, 2014). Hence investigations of disasters and their repercussions, as well as differentiating areas and applying different scales, need to establish the spatial-temporal frameworks (Koselleck, 2014) capable of allowing an integrated and interdisciplinary approach to the multidimensionality of spaces, beings and phenomena correlated in their complexity (Morin, 2003; Vasconcelos, 2002).

FROM DISASTER TO UNCERTAINTIES

On the upper Doce River, in the sub-basin of the Carmo River, the disaster killed people, left others homeless, devastated the aquatic ecosystems and courses of the rivers, radically altered the landscape, destroyed localities and razed properties, among other catastrophic impacts. The losses for the human communities are definitive and cannot be resolved by mitigatory actions, since, even if they respond to material issues, they cannot resolve symbolic and subjective questions: Bento Rodrigues ceased to exist.

On the middle Doce River, between its confluences with the Carmo and Guandu Rivers, soon after the state border between Minas Gerais and Espírito Santo, the slurry killed ichthyofauna, drastically affected diverse alluvial species and ecosystems, particularly in the Rio Doce State Park (Parque Estadual do Rio Doce: PERD), and harmed the riverside populations, directly affecting those who depend on the river for their water supply, irrigation, fishing, tourism, sport or leisure. Among those directly affected, the capacity of resilience is very unequal. At one extreme are, for example, fishermen, sand collectors and family farmers; at the other, a large company like Celulose Nipo-Brasileira S.A. (Cenibra).

On the lower Doce River and in the coastal waters the impacts were similar to those of the middle Doce River. Depending on the dimension considered, though, the time taken by the waste to reach these areas allowed the local governments to mitigate some of the effects. Nonetheless, at the mouth of the

Doce River and on the coast of Espírito Santo state, as the mud advanced into the sea and spread out, the effects were harmful and directly affected the ecosystems and the ways of life of the populations, with effects still present for the fluvial and marine ecosystems and for fishermen, small traders and tourist service providers, especially residents of the settlement of Regência, at the mouth of the Doce River.

Unlike the upper Doce, on the middle and lower courses of the river it seems that life returned to normal. However, when the scale is increased and we look more closely, it becomes clear that this happened from neither a material nor a symbolic viewpoint. Some indicators are the fact that people continue to consume mineral water, fishing is still banned, except for some species or for leisure purposes, tourists have stayed away and farmers are still unable to obtain answers about the real quality of the river water for irrigation. In the basin of the Doce River, the population directly or indirectly affected, in different degrees, became aware that not just the Vale do Rio Doce company existed (a named changed to Vale S.A. in 2009) and, at the same time, experienced a form of collective fear. This situation was reinforced in March 2018, when pulp of iron ore leaked in the municipality of Santo Antônio do Gramma, caused by the rupture of a pipeline belonging to Anglo American Corporation, which operates mines in the municipality of Conceição do Mato Dentro.

From the disaster has emerged the awareness that industrial mining represents a major risk and places at risk people and the environment. The disaster and the probability of new disasters introduce a new component: uncertainty. The disasters and calamities tend to inaugurate the time of uncertainty in the Kierkegaardian sense: a climate of negativity provoked by a vague and indeterminate threat (different from the fear resulting from a specific object). This feeling is made even more intense by the distrust provoked by the behaviour of the companies involved in the disaster (Samarco/Vale/BHP) and the governments (Federal/Minas Gerais/Espírito Santo).

This time of uncertainty can be defined as a 'landscape of fear,' in the terms formulated by Tuan (2005): a general climate of fear in relation to a supposed danger that will bring disaster and, at the same time, the sensation that the disaster-bearing force has its own will and cannot be controlled. Hence in the days, weeks, months and even the three years after the disaster, people continue to feel insecure in the face of real dangers, the perceived and the presumed (imagined). This state of uncertainty grows due to the lack of information or distrust of the information on the nature of the dangers and the extent of the risks: in what and in whom to trust.

Although the initial impact has passed, the people affected directly, or even indirectly, face multiple stress factors as a result of the calamity that followed the rupture of the Fundão dam. The landscape of fear became consolidated as a function of the individual and collective stress caused by the uncertainties provoked by the disaster and potentialized by the lack of effective coordination between the actors responsible for dealing with the impacts and for the mitigatory actions. Questions without answers foster the growth of the landscape of fear: What were the real impacts provoked by the disaster? What is the true level of contamination of the environment? Can other disasters occur?

The uncertainties remove legitimacy from the discursive practices of the private and public actors associated with the cause and consequences of the disaster; they undermine the public officials and the Renova Foundation, created by the Samarco/Vale/BHP companies to meet the judicial orders to reconstruct, restore and repair all the damage caused by the rupture of the Fundão dam. A conflict of narratives emerges: accident, disaster or crime? The disaster victims and the population of the affected areas (public opinion), with the support of actors linked to social movements, churches and popular entities, tend to criminalize and demand punishment for the guilty. In this context, disregarding it, the Renova Foundation is presented by Samarco as an ‘independent organization’ and, at the same time, positions itself as an agency with a high degree of legitimacy, which “brings together technicians and specialists from diverse areas of knowledge, dozens of entities working on socioenvironmental issues and scientific knowledge from Brazil and the rest of the world,” in which more than 7,000 people are working “in the reparation process, from Mariana to the mouth of the Doce River.”⁵ In fact, Renova functions as an ‘invisibility cloak’ for the Samarco/Vale/BHP mining companies by channeling to itself the attentions and discursive practices of all the actors involved in the process of remediation, restoration and compensation determined by the Term of Transaction and Adjustment of Conduct (Termo de Transação e Ajustamento de Conduta: TTAC).⁶

The Renova Foundation classifies the victims as beneficiaries and, at the same time, question the authenticity of their status as victims. This led the Civil Police to open an inquiry into fraudulent identities – for example, to check if there are people who are pretending to be fishermen in order to receive the benefit paid to this group due to the paralysation of their activities following the disaster. The Federal Public Prosecutor’s Office (Ministério Público Federal: MPF), the Ministry of Public Labour Prosecution

(Ministério Público do Trabalho: MPT), the Minas Gerais State Public Prosecutor's Office (Ministério Público do Estado de Minas Gerais: MP-MG), the Espírito Santo State Public Prosecutor's Office (Ministério Público do Estado do Espírito Santo: MP-ES), the Federal Public Defender's Office (Defensoria Pública da União: DPU), the Minas Gerais State Public Defender's Office (Defensoria Pública do Estado de Minas Gerais: DP-MG) and the Espírito Santo State Public Defender's Office (Defensoria Pública do Espírito Santo: DP-ES) issued recommendations to the companies Samarco, Vale and BHP Billiton against the behaviour of the Renova Foundation.⁷ The attitude of the Legislative and Executive powers of Minas Gerais from the first moment and over the three years that followed was to relax the environmental licensing for the mining company operations, since approval of Executive proposal no. 2.946/2015, twenty days after the rupture of the Fundão dam (25 November 2015). The conflict of narratives and the behaviours of the decision-takers have only augmented the uncertainties and strengthened the feeling that other harmful events will occur.

As Tuan (2005) points out, government behaviour influences the population's reaction. When the latter perceives the public authorities as reliable and just, it tends to trust in them. However, when it sees them with distrust, insecurity and fear grow. The victims and the general public fight to obtain reliable sources of information. However, many end up simply not believing in the diagnoses and positive prognoses. According to Button (2010, p. 11), the information issued by the parties involved in the disaster (media, public authorities, specialists from different fields of scientific knowledge, non-governmental organisations, etc.) releases a cacophony of communications that the affected population understands as conflicting and confused.

Different experts of science and technology (S&T) are convoked to explain, investigate or resolve the negative effects of the socioenvironmental disasters of a technological kind. S&T is unable to respond to the demands of the different actors in an immediate and peremptory form without contradicting itself. Without success, private institutions, corporations, government agencies and public authorities frequently turn to academics and/or specialists and pressurize them to explain events and, principally, eliminate the uncertainties of public opinion. Specialists are also convoked when uncertainties need to be produced, in cases in which actors with power need to discredit or confuse public opinion in response to the announcement of an alternative or independent source. This further exacerbates the uncertainties.⁸

Keen for events to reverberate and increase their audience share, the media outlets seek responses that fit into short and easy-to-understand journalistic phrases.⁹ The media professionals pursue their daily agendas following the logic of sensationalism and spectacle (bombastic announcements, rhythm and repetition), capable of attracting and capturing the public's attention. The specialists come under pressure to meet the demands of the press and provide simple and immediate responses, and, in this way, end up being pulled inside the situation of uncertainty, increasing the cacophony and tensions between the narratives.

The conflicting narratives, the prevailing sense of distrust in relation to governments and the scepticism concerning the discourses of scientists/specialists intensify the uncertainties. The slow pace inherent to scientific investigations becomes painful, particularly for those communities directly and indirectly affected by disasters. Furthermore, scientists very often become perplexed or feel impotent when faced with the preoccupations expressed by victims and the fears that they manifest. As Nelkin (1985, p. 18) reminds us, some uncertainties – despite all the efforts made – cannot be properly explained since there is insufficient scientific knowledge for the answer to be obtained.

The various tools of environmental risk analyses were fashioned in the supposition that uncertainties could be resolved through more science. However, it is possible to assert that the “risk concepts, methods and measures were refined within private technical debate, but not subjected to wider debate” (Wynne, 2002, p. 467). In this sense, the environmental risk studies do not critically challenge the dominant view of S&T policy: it is just a question of time until the predictive power of science is entirely within human reach. A change in this behaviour “would entail [...] a realist public discourse” in the sense of “breaking down the public denial of lack of control which, despite the growing emphasis on ‘uncertainty,’ is still a central feature of the dominant institutional culture” (Wynne, 2002, pp. 472-473).

The question that needs to be highlighted when S&T comes face-to-face with disaster contexts is the intensification of scientific controversy (a dispute between specialists). Two storylines begin to compete: one pessimistic (the recuperation will take decades; it will cost millions of reais, etc.) and the other optimistic (which mobilizes the slogans of reparation, restoration and reconstruction with the support of S&T, extension and community action). However, beyond S&T, the disaster reveals and mobilizes different actors who multiply the confrontation of negative and positive narratives. Who is certain? This question is secondary since the answer would only increase the

controversy. The relevant question is knowing which voices are being heard (authorized) and which are not, thereby seeking to delineate a broader and integrated context that enables the emergence of the power relations, the different voices and the extent of uncertainties, in order to measure the real meaning of the disaster for different actors.

Over the course of the twentieth century an ample literature emerged on the role of risk in modern society, but the uncertainty was pushed into the background. Risk has been treated, in part, as an attempt to overcome or diminish the uncertainty and thus protect citizens or minimize dangers of all types. As uncertainty is not easy to analyse, unlike risk, this category has been left out, although it is an essential part of the equation of risk mitigation. For Button (2010), however, uncertainty is operational and functions well to explore and categorize lived experiences, especially in order to problematize the different dimensions – and particularly when the future appears under threat. Hence the recognition of uncertainty becomes a fundamental component for the analysis and comprehension of disasters.

FROM THE MEDIATIC APPROACH TO THE PERTINENCE OF THE OBJECT

On November 5, 2015, before 5 pm, the newspapers via their websites and the television channels were already covering the rupture of the tailings dam of the Germano mine, owned by the company Samarco (a joint venture between Vale and BHP Billiton).¹⁰ At first, with no details about the event yet, figures were divulged, but frequently altered. The images from the first few days focused on the destruction of districts of the municipality of Mariana, Minas Gerais, particularly Bento Rodrigues, as well as the Doce River covered by the mud tailings and scenes with dead fish and animals.

Taking the newspapers *Estado de Minas*, *Folha de S. Paulo* and *The New York Times* as examples of the regional, national and international media outlets, respectively, we can obtain a sample of the press's behaviour. The period surveyed was from 2014 to July 2018. A date prior to the Samarco/Vale/BHP disaster was fixed in order to search for reports correlated with the topics of mining and dams. For 2014, what stands out are the projects for expanding mining production, including Samarco's, with a fourth pellet plant (P4P) and the new pipeline; the enthusiasm with the "growth of production" and the search for "maximum operational efficiency"; awards also appear and the mining company's marketing: "Once again we report to society on our socio-environmental performance, reinforcing our commitment to building trust."

After the disaster, strong images predominate and the tragic drama centres on four pillars: the devastation caused by the dam's rupture; the path of the mud and the successive impacts; the response and behaviour of the victims and the representatives of the company and governments; and the actions of the federal and state Public Prosecutor's Offices (Ministério Público: MP). The news reports proliferate, covering the entire extent and types of impacts on the environment, towns and people along the basin of the Carmo River, the channel of the Doce River and the sea. The press covered people's reaction, the situations of suffering, fear and despair, with strong images of the areas hit and the people affected, very often focusing on events from a sensationalist viewpoint – for example, in the coverage of the raids on trucks distributing mineral water. The daily reports on the disaster contribute to raising awareness of the risks represented by large-scale mining.

In 2016 and 2017 the topic remained widely reported,¹¹ with the media agenda centred on the results of the investigations; on the companies involved; on the creation of the Renova Foundation, which began to occupy a growing space in relation to the disaster; on the TTAC signed by the governments and companies, with its contestation by the Public Prosecutor's Office, and the reaction of the victims, the dioceses of the Catholic Church that cover the basin of the Doce River, and prominent figures, among others; on the environmental recuperation plans; on the lawsuits against people identified as criminally responsible and against the companies – “people are still waiting for the resettlement, for compensation, for a clean river, whose complex reparative actions encounter delays and obstacles that challenge the agencies involved” (Exame, 3 November 2017).

In 2018, the number of news reports on the disaster diminished significantly, except in the regional press.¹² As the number of references declined in the media outlets available on the internet, there was a growth in academic output registered in the most common and accessible databases, such as Google Scholar, Scielo and Periódicos Capes.¹³ Google Scholar is an indicator of this growth: for 2016, we found 190 references; for 2017 this number rose to 290, and in 2018, until July, 186 references were found on this subject in the database.

The form in which the media outlets, particularly the TV channels, frame news events strongly influences the way in which the public interprets and perceives reality, as well as political leaders, representatives of civil society organizations, public policy formulators, decision makers and corporate actors.¹⁴ The protocol followed by journalistic coverage demands that for each news item, the opinion of the ‘expert’ is introduced, whose function is to validate the narrative.¹⁵ With the expert's help, the media coverage to some extent shapes and

defines society's responses to the events. Rovida (2010, p. 31) observed that this is irrespective of whether the specialist receives peer recognition within his or her field of expertise. This is irrelevant insofar as the mere presence of an expert enables the press "exert a certain influence within other fields." In relation to the Samarco/Vale/BHP disaster, different specialists were mobilized.

Button (2010) argues that media coverage of disasters – especially technological disasters – tends to treat them as fortuitous events, an occurrence naturalized by the mechanisms of the narrative. This is more frequent, the author suggests, in technological disasters in which large companies are responsible, when, after initially informative media coverage, omission or silence is adopted (the disaster filed as a non-event).¹⁶ For Button, not only the storyline that governs the narrative content, but the media form itself heightens the distrust of the affected populations, who do not identify themselves in what they hear and watch. As they try to regain control of their lives, members of the impacted communities tend not to trust the narratives set by the media and the corporations responsible for the disaster's occurrence, nor those narratives originating from the governments and their agencies.

In the case of technological disasters or those with similar components, the communities from the affected areas tend to display frustration in relation to the media's behaviour (Button, 2010). People, animals, plants and local landscapes provide the scenes for journalistic coverage, but once the initial moment has passed, the subject fades away. The everyday drama of those affected by the disaster ceases to interest the press outlets and, as a result, the disaster gradually disappears from the news as the media space becomes occupied with other events – that is, with the 'latest news.'

In the Samarco/Vale/BHP disaster, differently to what Button (2010) identified in the disasters that he investigated, press coverage followed a storyline of denunciation that has tended to remain over the three years following the event, albeit sporadically from the third year on. In Button's study the media tended to naturalize disasters and, simultaneously, overlook human responsibility. The Brazilian media's coverage does not fail to mention and/or hold responsible the three mining companies for the disaster, even denouncing the impunity of those responsible and echoing the criticisms made of the Renova Foundation – especially in relation to the delay in compensations and the treatment given to the victims. This is clear in the headline "After two years, environmental impact of the Mariana disaster still not fully known," on the site of the BBC, published on November 5, 2017, and the headline "Three

years after the Mariana tragedy, feeling at home again is still a dream of the victims,” published by the G1-MG/Globo site on November 5, 2018.¹⁷

The journalistic images and texts combined with the expert opinions to make the disaster an event with a negative impact on people, societies, economies and the environment, reinforcing uncertainty or even the sense of abandonment by those responsible for the disaster, or, principally, the condemnation of the inertia of the public authorities. This behaviour presented by the Brazilian media is explained by the particular circumstances of the Brazilian political scene at the time of the disaster and in the months that followed, marked by the process of impeachment of president Dilma Rousseff (2 December 2015 to 31 August 2016). The denunciations of corruption by the Lava Jato operation were at their peak, as well as wide coverage of the middle class demonstrations in favour of the impeachment. In this setting, the spectacularized disaster was one more component added to the media coverage that led to the impeachment.

While the disaster was still very much present in the media in 2017, with heavy emphasis given to the situation experienced by the victims, in 2018 the tendency was for the subject to fade, with a few exceptions. Among the latter we can highlight the documentary produced by filmmaker Walter Salles, *Vozes de Paracatu e Bento* [Voices from Paracatu and Bento], shown on GloboNews, on August 11, 2018, in which the victims were able to express themselves freely. However, the entrance of other storylines can be noted, such as the positive actions of the Renova Foundation’s initiatives and the economic, social (unemployment) and tax losses caused by the paralysation of the mining activities for the municipalities of Mariana and Anchieta and for the respective states of Minas Gerais and Espírito Santo.

The previous storyline is maintained to a certain extent, particularly through the actions of the Public Prosecutor’s office against the behaviour of the Renova Foundation and against the out of court settlement agreed between the governments and companies (TTAC), and through the negotiation of the Conduct Adjustment Agreement (Termo de Ajustamento de Conduta) between the mining companies Samarco, Vale and BHP Billiton, the Public Prosecutor’s Offices, the governments of Minas Gerais and Espírito Santo and the state and federal Public Defender’s Offices (TAC – Governança), homologated, on August 8, 2018, by the federal judge Mário de Paula Franco Júnior. However, the legal provisos added by the federal judge, which altered the original text of the TAC – Governança, received little attention from the media,

likewise the criticisms that leaders from the affected population and social movements made of these legal provisos.¹⁸

Gradually, the Renova Foundation occupied a central place in the press as its resources, its work in the Doce River basin and its relationship with the political authorities, civil society and the affected population grew. For Renova, the victim is a beneficiary and the compensation paid a benefit. It seeks to assume the lead role, acting as a de facto river basin agency, both independently and executing the decisions of the Interfederative Committee (Comitê Interfederativo: CIF).¹⁹ In practice, the CIF took over the role of the Doce River Basin Committee (Comitê da Bacia Hidrográfica do Rio Doce: CCH-Doce) and the Renova Foundation the role of the CBF-Doce Water Agency (Agência de Águas do CBF-Doce / Instituto BioAtlântica – IBIO). This new protagonism gained space in the media, as well as possessing its own channels of communication and information.

However, the tendency towards naturalization is strongly resisted by the disaster victims and by popular and socioenvironmental organizations – who receive support from the Archdioceses of Mariana (MG) and Vitória (ES), as well as dialoguing directly with the Public Prosecutor's Offices. As a response, the Doce River Permanent Forum (Fórum Permanente do Rio Doce: MG) and the Doce River Capixaba Defense Forum (Fórum Capixaba de Defesa do Rio Doce: ES) were formed. Diverse initiatives emerged, including public actions, caravans, diverse events and the blockade of the Vale S.A. railway, as well as forming independent networks and media channels, such as the newspaper *A Sirene* and WikiRioDoce, which defines itself as an Open Wiki for the collaborative systemization of content related to the Doce River basin.

FINAL CONSIDERATIONS

Taking into account the questions raised in the previous sections, here we emphasize the need to consider separately the three areas into which the Doce River is divided (its upper, middle and lower courses) and to use the notion of risk and uncertainty to approach the Samarco/Vale/BHP disaster. The differentiation of the areas can be made more precise when the specific sections of the river are distinguished. This differentiation is proposed by the National Water Agency (Agência Nacional das Águas: ANA. Proton Doc. 139/2016 – Technical Report): along the entire extent of the river system travelled by the mud waste, fluvial and marine ecosystems were dramatically affected. However it recommends differentiating the effects according to the specific regions of the basin.

Systemic studies to evaluate the impacts of the disaster in the Doce River basin as a whole have still yet to be produced. Neither have diagnoses and prognoses been undertaken of the presence of dozens of dams belonging to diverse mining companies operating in Minas Gerais, or of the real risks of rupture. Technical mining systems are indissociable from tailings dams, particularly since the shift to mining low-grade iron ore. The localization of the dams, the geographic relief, the drainage network or river basin network, the localization of human settlements, production or administrative structures, rural properties and tourism facilities, among others, represent effective risks, which in the case of the Samarco/Vale/BHP disaster were tragically confirmed.

Places and ecosystems suffer diverse impacts, and the capacities for confrontation and resilience can vary considerably from case to case (Bankoff; Frerks; Hilhorst, 2008). Studies of mining disaster also need to include a bio-cultural ethics, which equally considers all the coinhabitants (human and non-human), their habitats and habits, attributing the same value/weighting to the losses suffered individually without any kind of distinction (Rozzi, 2013). While, for the towns affected by the Samarco/Vale/BHP disaster, the water supply was quickly re-established (despite the population's persistent distrust about its drinkability), for rural communities, which depend entirely on the Doce River, the situation remains uncertain, even three years after the rupture of the Fundão dam. For fishermen and family families, the future remains uncertain; the residents of Bento Rodrigues are still dispossessed; the contaminated waste material reached the coral reefs of the Abrolhos National Marine Park (Parque Nacional Marinho dos Abrolhos). In other words, the disaster continues to unfold.

Considering the proposed reflection on the risk and uncertainty that results from the successive repercussions of the Samarco/Vale/BHP disaster, we can propose a final framing in three perspectives: mediatic, uncertainty and revelation (apocalypse). In the first occurred the spectacularization of the disaster, with the transmission of striking images and dramatic testimonies, with an emphasis on common people and the environment. The second perspective deals with the problem of uncertainty that emerges from the disaster, whose direct impacts are not limited to the basin of the Doce River, but extend to Espírito Santo and have repercussions in Brazil and the rest of the world. The fear of a new disaster grew with the multiplication of information from specialists and the lack of trust in the companies and governments. The uncertainty increased with two leaks of pulp of iron ore from the Anglo American pipeline in March 2018. The feeling of uncertainty, over the following years,

will continue to produce its effects on the population and the different actors. New occurrences could make this feeling increase exponentially.

As a topic wrapped in shadows, ambiguities and mysteries, can the light of science explain what happened and answer the many questions about the present and the future? Media coverage seeks validation through the pronouncements of experts (“the expert declared...”), but instead of certainties, only confirms that science itself has become part of the controversies (Latour, 2004). The proliferation of expert opinions in diverse media outlets amplifies the controversies between the different sides and contributes to increasing the feeling of uncertainty. This controversy hit the headlines with a claim made by biologist Márcia Chame, from Fiocruz, linking the rise in suspected cases of yellow fever in Minas Gerais to the Samarco/Vale/BHP disaster (Estado de Minas, 14 January 2017).²⁰ This supposition multiplied and the spread of the disease also became included as part of the legacy of the disaster. According to the news report of *Correio Braziliense* (29 January 2018),²¹ the ‘rumour’ spread through social media after the interview with the biologist. Fiocruz, however, communicated that no study existed to prove this link. According to Fiocruz, the expert’s declaration did not associate the outbreak specifically with the rupture, “but with a broad sequence of actions of devastation that have been removing the habitat of contaminated monkeys and forcing them closer to urban areas over the last century.” Fiocruz underlined that it was a complex process: “There are impacts with many origins over the course of history. In the past, the yellow fever cycle remained in the forest,” the expert declared.

In the third perspective, the Samarco/Vale/BHP disaster can be associated with the idea of apocalypse (Zizek, 2012), not in the sense of a terrifying vision of the present, but as revelation, in the sense of uncovering or removing the veil. What and who does the Samarco/Vale/BHP reveal? This perspective can offer an alternative line of critical inquiry within the interdisciplinary approach. It reveals the importance and centrality of the mining economy for Minas Gerais, port states (Espírito Santo and Rio de Janeiro) and the country, as well as the risks and the sociotechnical, socioterritorial and socioenvironmental contradictions of the mining complex.

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NOTES

¹ This article involved the collaboration of the Pibic/Fapemig scientific initiation scholarship holders Natália Moreira Ferreira, student of the 10th semester of Civil Engineering at Univale, and Iesmy Elisa Gomes Mifarreg, student of the 6th semester of Law at Univale, as well as financial resources from Fapemig: APQ-00525-16 and Univale: SHA 048910-17.

² Observation should consider all coinhabitants, their habits and habitats, treating the peo-

ple and specimens affected as possessing the same value, with the individualization needed to achieve the correct evaluation of the effects of the disaster. It is also necessary to verify the impacts on resources and conditions of the ecosystem both for these people/specimens and for the landscape and symbolic factors.

³ Technical Report produced in 2013 by the Pristino Institute, contracted by the Minas Gerais State Public Prosecutor's Office, which presents in detail all the safety problems relating to the dams and identifies the direct risks for the Bento Rodrigues community. The report is available at: <http://giaia.eco.br/wp-content/uploads/2015/11/Resposta-parecer-257-2013.pdf>. Accessed on: 20 August 2018.

⁴ The Iron Quadrangle is subject to tremors, so much so that Vale S.A., in conjunction with the USP Centre of Seismology, implanted a network of five broadband stations to monitor local and regional seismicity. See COLLAÇO et al., 2017.

⁵ The claim that the Renova Foundation operates as an 'independent organization' was taken from the website of Samarco Mineração S.A., available at: <https://www.samarco.com/relatoriobienal20152016/pt/fundacao-renova.html>. On how the Renova Foundation defines itself, see: <https://www.fundacaorenova.org/a-fundacao/>. Accessed on: 20 August 2018.

⁶ The Transaction and Conduct Adjustment Agreement (Termo de Transação e Ajustamento de Conduta: TTAC) is an out of court agreement between Samarco/Vale/BHP and the federal government and state governments of Minas Gerais and Espírito Santo, signed 2 March 2016.

⁷ The recommendations against "abuses of the Renova Foundation" can be found on the website of the Federal Public Defender's Office, published 5 April 2018. Available at: <https://www.dpu.def.br/noticias-defensoria-publica-da-uniao/233-slideshow/41875-mps-e-defensorias-expedem-recomendacao-para-frear-abusos-da-fundacao-renova>. Accessed on: 20 August 2018.

⁸ The Federal University of Espírito Santo (Universidade Federal do Espírito Santo: UFES) created the 'Doce River Sea Network' with the participation of around 500 researchers from different Brazilian institutions. This network received 120 million reais from the Renova Foundation for the research without any public competition. For Edmilson Teixeira, coordinator of LabGest-DEA/Ufes and the Doce River Sea Network, the latter "will act in diverse forms, including being able to provide support to the Renova Foundation, which was established through a Transaction and Conduct Adjustment Agreement (TTAC), agreed between Samarco, its shareholders and the governments of Minas Gerais and Espírito Santo." In his words: "Renova was recommended by the public authorities, which today manages the resources for recuperation." See "Rio Doce ganha mais um reforço na tentativa de recuperá-lo," *Redação Multimídia ESHOJE*, July 2017. Available at: <http://eshoje.com.br/rio-doce-ganha-mais-um-reforco-na-tentativa-de-recupera-lo/>. Accessed on: 20 August 2018.

⁹ "Nenhuma lição aprendida pelo poder público, diz procurador após dois anos da tragédia de Mariana," G1 MG and TV Globo, 6 November 2017; "Barragem em MG: veja relatos de

sobreviventes do vilarejo destruído,” G1 SP/Globo, 6 November 2015; “Desastre em Mariana é o maior acidente mundial com barragens em 100 anos,” by Noelle Oliveira, Portal EBC, Brasília 15 January 2016; “Protesto pede volta das atividades da Samarco em Mariana,” MGTV/ Globo, 12 March 2016; “Desastre da Samarco aconteceu 2 anos após estudo alertar colapso em represas de MG,” InfoMoney/Reuters, 9 November 2015.

¹⁰ The disaster was immediately a major news story in Brazil and around the world, as can be seen in the headlines (translated): “Tailings dam ruptures in Mariana mining company; follow live,” website of the newspaper *Estado de Minas*, 5 November 2015 at 4:49pm; “Dam ruptures and flood of mud destroys Mariana district” G1-MG/Globo website, 5 November 2015 at 5:14pm; “Mining dam ruptures and inundates district in rural Minas,” EBC-Agência Brasil /Brasília, 5 November 2015 at 7:06pm; “Dam ruptures in MG and covers part of Mariana district in mud,” *Jornal Nacional/Globo*, 5 November 2015 at 8:52 pm; “In Minas Gerais. Disaster in Brazil: an avalanche of mine tailings inundates a locality,” *Clarín*, Argentina, 5 November 2015, 7:52pm; “Brazil Aerial Footage Shows Devastation,” *The New York Times*, 5 November 2015, no time; “Dam in MG was classified as low risk, says DNPM,” G1-SP/Globo, 5 November 2015 at 9:08pm; “‘Catastrophe’: At least 17 killed, 45 missing, town levelled by flood in Brazil dam collapse,” *World News/Rede RT/Russia*, 5 November 2015, 9:19pm; “Dozens missing in Brazil mine disaster, death toll uncertain,” *World News*, Reuters, 5 November 2015, 10:37pm.

¹¹ Survey of news items related to the disaster, in 2016 and 2017, in the three media outlets: in 2016: *Estado de Minas* (1,510 items), *Folha de S. Paulo* (47 items), *The New York Times* (10 items); in 2017: *Estado de Minas* (1,196 items), *Folha de S. Paulo* (19 items), *The New York Times* (no items).

¹² Survey of news items related to the disaster in the three media outlets for 2018 (until July): *Estado de Minas* (943 items), *Folha de S. Paulo* (no items), *The New York Times* (no items). The issue remained relevant at regional level but lost momentum at national and international levels. The same search terms were used.

¹³ The research used different keywords: ‘disaster’ ‘Samarco’ ‘Fundão dam’; next other words were added like: law, non-material damage, responsibility, engineering, territory, socioenvironmental, ecosystem, regulation, Public Prosecutor’s Office, Krenak, ethics, racism and bioculture.

¹⁴ The studies indicate that the media – including printed newspapers post-internet, television networks and social media – created a centrality that “derives from their potential to construct reality through the representation transmitted in their channels on the different aspects of human life” (PENTEADO; FORTUNATO, 2015, p. 133).

¹⁵ Every student of Social Communication learns that the “figure of the ‘expert’ is commonly required by the journalist to guarantee, or better, to reinforce the degree of legitimacy of their own line of argument” (FARIA, 2007, p. 4).

¹⁶ Manipulations can occur on the internet, as Philip Coppens of *Nexus Magazine* observed in the case of Wikipedia, where new elements were manipulated in January 2008 from a computer belonging to Dow Chemical Company, with the aim of deleting certain

information and judgments on the Bhopal disaster, which occurred in India on 3 December 1984 (BUTTON, 2010, p. 166).

¹⁷ G1/MG/Globo. Available at: <https://g1.globo.com/mg/minas-gerais/noticia/2018/11/05/tres-anos-apos-tragedia-de-mariana-sentir-se-em-casa-novamente-ainda-e-sonho-de-atingidos.ghtml>. Accessed on: 5 November 2018.

¹⁸ The provisos included by the federal judge on homologating the TAC-Governança prevent the participation of entities linked to “social movements or NGOs working in the area of the Mariana Disaster”; with a “subordinate relationship to religious entities”; and “whose entities/teams/professionals/individuals have any link/affiliation, direct or indirect, to political parties or party political activities.”

¹⁹ The Interfederative Committee (Comitê Interfederativo: CIF) was created after the signing of the TTAC, composed mostly by civil servants from the federal government and the state governments of Minas Gerais and Espírito Santo, as well as representatives from affected municipalities, victims, the Public Defender’s Office and the Doce River Basin Committee. The CIF is presided over by IBAMA and has the function of orienting and validating the initiatives of the Renova Foundation, instituted by Samarco and its shareholders, Vale and BHP Billiton, as a result of the same out of court agreement. Information on the CIF can be found on the IBAMA website.

²⁰ Available at: https://www.em.com.br/app/noticia/gerais/2017/01/14/interna_gerais,839487/para-biologa-pode-haver-relacao-com-a-tragedia-de-mariana.shtml. Accessed on: 20 August 2018.

²¹ Available at: https://www.correiobraziliense.com.br/app/noticia/brasil/2018/01/29/internas_polbraeco,656335/qual-a-relacao-do-surto-de-febre-amarela-com-o-desastre-de-mariana.shtml. Accessed on: 20 August 2018.

Article received 30 June 2018.

Approved 18 March 2019.

