

# The Vulnerable Region: Disasters in West Java in the 19th and Early 20th Centuries

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## Article history

Received : 2023-12-09

Accepted : 2024-09-13

Published : 2024-09-30

## Keywords

Disaster,  
Earthquake,  
Volcanic Eruption,  
Environmental History,  
Colonialism

**Abstract:** This article examines the disasters in West Java during the nineteenth and early twentieth centuries, focusing on earthquakes and volcanic eruptions. These events, frequently reported in newspapers, garnered the attention of colonial scientists due to their potential threat to colonial economic and political interests. The initial response involved systematically documenting these occurrences annually, a practice aligned with global efforts to understand these natural phenomena. Consequently, annual reports have become abundant. Through systematic analysis of reports routinely published in the *Natuurkundig Tijdschrift voor Nederlandsch-Indië*, this article analyzes the process of knowledge production about earthquakes and volcanic eruptions during the colonial era, using West Java as a case study. Additionally, it investigates how these natural disasters influenced political policies, particularly the relocation of the capital from Cianjur to Bandung. Finally, the article explores the evolution of knowledge production concerning advancements in science and technology and shifts in colonial politics.

**Abstrak:** Artikel ini mengkaji fenomena bencana di Jawa Barat pada abad ke-19 dan awal abad ke-20 dengan fokus pada gempa bumi dan gunung meletus. Kedua peristiwa bencana ini banyak mendapat pemberitaan dan kemudian menarik perhatian para ilmuwan kolonial untuk melakukan kajian lebih mendalam, karena keduanya sampai batas tertentu mulai dianggap sebagai ancaman bagi kepentingan ekonomi dan politik kolonial. Upaya awal yang dilakukan oleh para ilmuwan saat itu adalah pendokumentasian kedua peristiwa tersebut setiap tahun. Praktik ini cukup umum dilakukan di tingkat global, sebagai salah satu upaya untuk memahami kedua fenomena alam tadi. Konsekuensi dari itu, laporan tahun terkait kedua fenomena tersebut menjadi berlimpah. Dengan melakukan pembacaan sistematis laporan yang secara rutin diterbitkan di *Natuurkundig Tijdschrift voor Nederlandsch-Indië*, artikel ini akan menganalisis proses produksi pengetahuan gempa dan gunung meletus di masa kolonial dengan mengambil contoh kasus di Jawa Barat. Dari pembacaan secara serial laporan peristiwa bencana, artikel ini juga akan melihat sejauh mana fenomena gempa dan gunung meletus berpengaruh pada kebijakan politik, dalam hal ini perpindahan ibu kota dari Cianjur ke Bandung. Terakhir, artikel ini juga akan menganalisis perubahan proses produksi pengetahuan dalam hubungannya dengan perkembangan ilmu pengetahuan dan teknologi dan juga politik kolonial.

**Cite this article:** Jaelani, G.A., Rahman, F., Gustaman, B. (2024). The Vulnerable Region: Disasters in West Java in the 19th and Early 20th Centuries. *Paramita: Historical Studies Journal*, 34(2), 186-198. <http://dx.doi.org/10.15294/paramita.v34i2.49318>

## INTRODUCTION

The earthquake in Cianjur on November 21, 2022, caused a significant economic toll and human casualties. It also heightened concerns about the potential major disasters of the Lembang Fault. Lembang Fault is an active fault stretching 22 kilometers from West Cisarua through Lembang to Mount Palasari's eastern slopes. Although it has never been recorded as causing a large earthquake, the Lembang Fault shows geomorphic evidence of recent activity. Experts, nevertheless, believe



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that these concerns are somewhat unfounded. They compared the characteristics of the Lembang Fault to the Cimandiri Fault which is considered to have caused the Cianjur earthquake. Despite the different perceptions, the event has sparked questions about the historical record of disasters in Cianjur and West Java (Brahmantyo, 2011; Haryanto et al., 2017; Sudradjat, 2022). It is important nonetheless to investigate these questions for future disaster preparedness. In addition, focusing on West Java allows for examining the intensity and frequency of such events, shedding light on the prioritization of data collection by administrators and scientists during the colonial era.

The significant effects and concerns arising from the Cianjur earthquake set the stage for a historical exploration into how earthquakes and volcanic eruptions have been documented and interpreted in periods of early scientific development. In doing so, this study also focuses on lesser-known disaster phenomena, in addition to the historical focus on the eruptions of Mount Tambora and Mount Krakatoa (Abdurachman, 1983; Lapian, 1992; de Jong Boers, 1995; Gustaman, 2019; Rahman, 2019; Honings, 2020). The analysis pivots on the process and the implications of recording catastrophic events, drawing on the research framework established by Andrea Janku, Gerrit J. Schenk, and Franz Mauelshagen (Janku et al., 2012). In that spirit, this article underscores "the close and complex relationship between human civilization and the environment that supports it, and the subtle ways in which small and big 'disasters' have shaped human societies in the past" (Janku et al., 2012, p. 2).

Recent scholarly works provide new insights into Indonesia's disaster phenomena. Martin et al. have recently contributed to the field with 'Gempa Nusantara' (The Earthquakes in the Archipelago), a disaster database in Indonesia from 1547 to 1950. This systematic information represents a significant effort to map disasters and deepen understanding of how they manifest in Indonesia (S. S. Martin et al., 2022; S. Martin, 2022). However, as their research primarily falls within earth sciences, it solely focuses on geographical traits without extensively addressing the intricate interplay of economic, political, and religious factors. In contrast, Adam Bobbette's study combines geographical, historical, and anthropological perspectives. His work seeks to interpret volcanic phenomena through European knowledge and local understandings, examining how communities respond to and prepare for disasters (Bobbette, 2023). Bobbette's approach challenges the conventional view of myths, present-

ing them not as mere irrational beliefs but as systems with their logic, potentially offering more relevant explanations of volcanic activities. Additionally, a special edition of the *Indonesia* journal pays attention to disaster events, exploring the complexity of disasters with knowledge, local traditions, and colonialism (Bobbette, 2022; Protschky, 2022; Sastrawan, 2022; Zakaria, 2022).

Contrasting with the aforementioned studies, this article delves into colonial government reports on earthquakes and volcanic eruptions in West Java during the peak of colonial power in the nineteenth and early twentieth centuries. Analysis of the available sources indicates that West Java, a region that came to be administratively known as such, frequently experienced disasters of varying intensities throughout the nineteenth century. It is important to note that the high volume of recorded data from West Java does not imply a lack of similar events in other regions. As Elise Lenting's research highlights, of the 98 earthquakes recorded on the island of Java between 1869 and 1919, 46 occurred in West Java (Lenting, 1921, p. 58). The extensive documentation from this region is likely attributed to the significant number of European reports, correlating with the colonial government's substantial economic interests.

The documentation of past disaster events in this study extends beyond mere information collection. It aims to contextualize natural disasters within the evolving spheres of science and the political-economic landscape. By examining the practice of recording, this research demonstrates that disasters were increasingly perceived as threats to the colonial state's political and economic stability. Additionally, this article sheds light on the individual experiences in coping with disasters. It further challenges the long-held belief, as posited by Hardjasaputra (Hardjasaputra, 2002), that the relocation of the Priangan Residency capital from Cianjur to Bandung in 1864 was primarily due to frequent occurrences of disaster. Priangan Residency was an administrative division of the Dutch East Indies located in a mountainous region in southern and central West Java, extending roughly from Sukabumi to Tasikmalaya. The entire Priangan region became part of West Java province today.

This article is structured into three distinct parts. The first part presents a comprehensive review of the disasters that occurred in West Java, with a focus on three volcanic eruptions and two major earthquakes in Cianjur and Sukabumi. The next part analyzes the capital city's displacement based on the reports to assess whether these events

drove it. Finally, the article shifts focus to the evolution of research on volcanoes and earthquakes that has progressed in pursuit of more valid and reliable knowledge. By focusing on these three aspects, this article argues that in colonial West Java, the issues surrounding earthquakes and volcanoes were intricately tied to complex political, economic, and scientific considerations. It correlates to Indonesia's recent surge in disaster events and the growing focus on potential future catastrophes. Such research is vital for enriching Indonesian disaster and environmental historiography and improving future disaster preparedness strategies.

## METHOD

This study combines heuristics, critics, interpretation, and historiography as historical research (Wasino & Hartatik, 2020). It primarily utilizes disaster reports published in the journal *Natuurkundig Tijdschrift voor Nederlandsch-Indië* from 1850 to 1922. This journal, encompassing natural science in the Dutch East Indies, frequently features studies on earthquakes and volcanic eruptions. The information covers incident records, organizational reports, documentation, and analytical studies. Additionally, this article draws upon newspaper reports, contemporary monographs, and other relevant journals, such as *Jaarverslag Koninklijk Magnetisch en Meteorologisch Observatorium* and *Vulkanologische en Seismologische Mededeelingen* 1921-1928. Through extensive reading, this research employs the 'third level serial historical research method' ("*le troisième niveau*") as proposed by Pierre Chaunu (Chaunu, 1995). This approach extends beyond the conventional use of quantitative data for economic analysis, encompassing a broader spectrum of aspects, including societal mentality and disaster records. It facilitates an in-depth examination of shifts in reporting methods and the integration of more personal information within each report. This methodology allows for a nuanced understanding of how the perception and documentation of disasters have evolved.

## DISASTER RECORDS IN WEST JAVA

A compilation of disaster reports by A. W. P. Weitzel, covering the period from 1810 to 1829, documents the earliest recorded event: a mild earthquake in Buitenzorg (now known as Bogor) on December 16, 1810, at 19:30 (Weitzel, 1859). The report describes the earthquake as light in intensity. However, two years later, Buitenzorg experienced a strong earthquake on March 19, 1812, which was also felt in Batavia. Eyewitness accounts from this

event mention a particular roar, especially in the Weltevreden area.

Weitzel's compilation of disasters primarily draws upon newspaper reports, a common practice at the time. Newspapers during this period often functioned as a medium for government communication, disseminating policies and reporting on significant events (Coen, 2013; Vetter, 2011). They served the public with important occurrences, especially those deemed critical by colonial authorities (Termorshuizen, 1998). This practice of reporting and the significance attributed to such natural disasters is evident in the content. Weitzel's work, a detailed compilation of these reports, was later published in the *Natuurkundig Tijdschrift voor Nederlandsch-Indie* journal in 1859.

Systematic recording of disaster incidents emerged as a novel approach following the catastrophic Lisbon earthquake in 1755. This event marked a pivotal shift in Europe, transforming the perception of disasters from divine retribution to natural phenomena worthy of scientific study (Braun & Radner, 2005; Coen, 2013; Quenet, 2012). Efforts to understand these disasters began with collecting eyewitness and firsthand accounts of earthquakes and volcanic eruptions. This method gradually changed public attitudes, and people began to view disasters not as punishments but as indicators of their inherent vulnerability to natural forces. Despite advancements in data collection and a growing understanding of the frequency of such events, the ability to explain the causes and predict the timing of earthquakes and volcanic eruptions remained elusive.

As the Dutch East Indies government's interests grew, such initiatives gained momentum. Initially, they did not immediately recognize the significance when the incidents were reported in newspapers. This attitude changed in the mid-nineteenth century with the compilation work undertaken by Weitzel, Reiche, and Versteeg, chronicling earthquake and volcanic eruption events from 1810 to 1850 (Reiche, 1859; Versteeg, 1859; Weitzel, 1859).

The first half of the nineteenth century witnessed major catastrophic events, including the eruptions of Tambora, Guntur, Galunggung, Gede, and Merapi. These disasters wreaked havoc on colonial economic resources and later heightened the authorities' awareness of the inevitability of natural disasters. This realization led to the understanding that the most effective way to mitigate further damage was through dedicated research and study. Data collection became recognized as the primary and

most effective means to understand disasters. Historical analysis was assumed to enable predictions or preparations for future incidents, enhancing readiness for similar events (Perrey, 1845, p. 265; Jaelani, 2019, p. 42).

In these records, West Java emerges as the most frequently affected region. It is important to clarify that 'West Java' in this context refers not just to the present-day administrative region but to a broader geographical area encompassing the western part of the island of Java, including what are now the provinces of West Java, Greater Jakarta, and Banten. According to the documentation by these naturalists, this expansive area, classified under the West Java category, witnessed forty-two instances of seismic and volcanic activity for forty years: sixteen earthquakes and twenty-six volcanic eruptions.

Multiple factors contributed to the frequent occurrence of disasters in West Java. A primary reason is the numerous active volcanoes in the region, including Mount Gede, Guntur, and Galunggung. These volcanoes erupted frequently within forty years, inflicting considerable material damage and impacting the colonial economy. While other areas also have active volcanoes, the reporting from West Java tends to be more detailed. This greater detail in reporting is partly due to the high concentration of the European population and their extensive socioeconomic interests in the region. Notably, these reports covered not only major catastrophes but also minor seismic events. When an eruption threatened economic interests, for instance, the reports became particularly meticulous, as exemplified by R. van der Capellen's account of the Galunggung eruption, which detailed the extensive damage to coffee plantations. Therefore, it is important to recognize that the absence of disaster reports in certain areas does not necessarily indicate the absence of disasters. This perspective is crucial when considering the high volume of disaster reports from West Java (Van der Capellen, 1829; Weitzel, 1859, pp. 218–232).

The frequent occurrence of earthquakes and volcanic eruptions in West Java is a phenomenon that warrants significant attention. Since the eighteenth century, the colonial authorities have capitalized on the economic potential, particularly coffee plantations. Additionally, key colonial government centers, such as Batavia and Buitenzorg, were located in this region, making the recording of disaster events crucial. Moreover, to an extent, it affected the decision to relocate the capital city of Priangan from Cianjur to Bandung. The following sections

will delve into several major earthquakes and volcanic eruptions of the nineteenth century, which served as preconditions for this capital relocation.

### **THE THREE MAJOR VOLCANOES: GUNTUR, GALUNGGUNG, AND GEDE**

Upon his first arrival on Java, Thomas Horsfield was immediately confronted with the direct impact of a volcanic eruption. He described the event in his writings: "On the night between the 6th and 7th April 1803, and for several hours at the end, a kind of fine, black, sand-like body, in the city and in the vicinity of Batavia, fell very slowly from the air" (Horsfield, 1814, p. 1). Initially, Horsfield was unaware that the ashfall in Batavia originated from the eruption of Mount Guntur and was carried to the city by the wind. Batavia residents similarly observed the phenomenon and were equally puzzled by the volcanic ash. It was only a few days later that news reached them about the ash from a volcanic eruption occurring approximately 200 kilometers to the east. As a doctor and naturalist, Horsfield was less interested in the eruption itself; instead, he was immersed in the mineral content of the volcanic ash. Nonetheless, Horsfield's observations underscore a critical insight: events occurring at great distances can still directly and potentially damage far-removed areas.

The 1818 eruption of Mount Guntur garnered a more detailed report from Caspar Georg Carl Reinwardt, a renowned naturalist and the then-director of the newly established Buitenzorg Botanical Gardens (founded in 1816). Upon hearing news from Robert van der Capellen, the Resident of Priangan, Reinwardt promptly traveled from Buitenzorg to the eruption site, a considerable distance away. This action reflected his dedication to natural science and eagerness to observe volcanic eruptions firsthand. His endeavors were followed by other naturalists, including Franz Wilhelm Junghuhn, who also ascended Guntur and conducted studies on the volcano's characteristics (Jaelani et al., 2023, pp. 113–114).

The accounts of the Guntur eruption extend beyond the scope of naturalist reports. Newspaper coverage of the incident also deserves attention, as it provides a more diverse set of information. These reports also covered elements related to colonial economic interests. Notably, the destruction of coffee plantations around Mount Guntur posed a significant threat to colonial profits, as documented in contemporary media sources (Jaelani et al., 2023).

The official report by, the Resident of Pri-

angan, on the 1822 eruption of Mount Galunggung serves as a notable example of detailed disaster documentation. This report, later published in the 'Bataviasche Courant', describes the devastation caused by the eruption and highlights the substantial physical damage and the high number of human casualties. The lack of awareness about Galunggung as an active volcano contributes to the severity of the impact. Residents living near the volcano had no collective memory of any previous eruption, so they were unprepared for the unexpected event. The situation worsened with a second, more devastating eruption occurring just four days after the first, as people believed that the danger had passed. This subsequent eruption resulted in greater casualties and damage to thousands of coffee trees, the Priangan's substantial commodity at that time (Van der Capellen, 1829). The concern about the coffee plantations shows colonial anxiety about their disrupted economic operations (Jaelani et al., 2023).

Similar nuance can also be found in reports of Mount Gede in Cianjur which erupted on November 12 and 14, 1840. The initial accounts, published in the 'Javasche Courant', described the sighting of thick smoke clouds emanating from Mount Gede. Observers in Cianjur also noted the visible glow of fire and experienced ashfall within the city. Sounds resembling cannon fire, characterized by rumbling and blaring, were reported as well. Interestingly, the report dated November 21, 1840, did not explicitly label these occurrences as an eruption of Mount Gede. They were referred instead as natural phenomena indicative of increased volcanic activity (Reiche, 1859, pp. 278–279).

The eruption of Mount Gede was officially confirmed in a subsequent report by the *Javasche Courant* dated November 28, 1840, a week after the initial observations. It provided a more detailed account of the eruption, noting that it caused severe tremors and considerable physical damage in Cianjur. The report also mentioned the frequent occurrences of loud, cannon-like booms heard in various locations. Furthermore, it highlighted that the last recorded eruption of Mount Gede had occurred 79 years prior, in 1761, thereby indicating the volcano's long period of dormancy before this event (Reiche, 1859, pp. 280–281).

Following the 1840 eruption, Mount Gede entered a phase of heightened activity, with several eruptions recorded in subsequent years, including in 1845 and 1847. The reports consistently focus on the damage inflicted on coffee plantations. The capital city of the Priangan Residency, Cianjur, also

often sustained significant physical damage from these eruptions due to its proximity to the volcano. This recurring impact on Cianjur prompted considerations in the mid-nineteenth century regarding the relocation of the Priangan capital, as a strategic response to the ongoing volcanic threat posed by Mount Gede (Versteeg, 1859, pp. 295–297).

#### DISASTERS AND CAPITAL RELOCATION

The relocation of the residency's capital from Cianjur to Bandung was initiated through a letter from the Resident, dated May 21, 1864. The initiative had been considered for over a decade, yet its implementation was postponed due to various debates regarding benefits and drawbacks, and the required funding (Dienaputra, 2004). On the other hand, this relocation was ultimately prompted by a natural disaster—the eruption of Mount Gede in mid-1864 (Hardjasaputra, 2002, pp. 124–130). The specific mention of the year 1864 in Hardjasaputra's dissertation might be a typographical error, as the official decree for the capital's displacement was issued in August of that year, suggesting that the intended reference could have been to mid-1863. This also means the absence of reports of Mount Gede erupting in 1863. Even in more recent studies and reports focusing on volcano activity, there is no indication of increased volcanic activity during that year. Therefore, the argument that a disaster event drove the relocation of the capital city, specifically the eruption of Mount Gede, lacks substantiation in historical records.

The historical record demonstrates that West Java, particularly Cianjur, was frequently afflicted by natural disasters throughout the nineteenth century. Volcanic eruptions and earthquakes were recurrent phenomena, with Mount Gede's heightened activity in the mid-nineteenth century causing consistent damage to the Cianjur area. In response to almost every seismic event, the people of Cianjur would instinctively look towards Mount Gede, seeking to ascertain whether the tremors were from volcanic activity. While not all activities were directly linked to the volcano, the impact was far from negligible.

Three years before the relocation of the capital, Cianjur experienced two major earthquakes. The *Batavia Nieuwsblad* issued on November 20, 1861, covered an earthquake in Batavia on November 16, 1861. The report mentioned that it was more intense in Buitenzorg, causing damage to the telegraph office ("Aardbeving," 1861). Notably, the article did not provide information about the impact on Cianjur. This omission could be attributed to the

newspaper's location and possibly a delay in receiving detailed information about the events as they unfolded in Cianjur. The *Javasche Courant* issue dated November 27, 1861, provided additional details about the aftermath in Cianjur reporting: "At the main town of Tjiantjoer, on Saturday, November 16th in the evening at 6:40 pm, a heavy earthquake shock was felt. This was followed by smaller tremors at 6:50 pm, at 8:30 pm, and again on the morning of November 22nd at 5:30 am." It also mentioned that, in addition to the initial quake on the 16th, Cianjur experienced an aftershock on November 22, offering a more comprehensive view of the seismic activity ("Binnenlandsche Berigten," 1861).

Ten months later, on August 22, 1862, Cianjur experienced yet another substantial earthquake. The *Java Bode* reported on September 6, 1862, that the effects extended to Manondjaja, Garut, and Sumedang ("Vertrokken Passagiers van Batavia," 1862). Further seismic activity followed, as detailed in a later in the *Java Bode* issue of September 27, 1862: "[O]n the 17th of September at 6 hours and 17 minutes, two consecutive, fairly severe earthquake shocks were felt in Tjiandjoer. They continued, at a short interval, for 5 or 6 seconds, from the direction of the east to the west" ("Aangekomen Passagiers Te Batavia," 1862).

The series of damaging earthquakes in Cianjur played a significant role in the decision to relocate the capital. However, official records do not directly attribute this move to the seismic events. Discussions about relocating the capital had been ongoing since the 1850s, primarily framed as a strategic decision without explicit mention of natural disasters. Despite this lack of direct reference, it is difficult to entirely disconnect the relocation from the frequent disasters that plagued Cianjur. As demonstrated by the data, Cianjur was one of the regions most recurrently affected by natural calamities, resulting in consistent damage that was inapt for a center of administration.

### THE 1879 CIANJUR DAN 1900 SUKABUMI EARTHQUAKES

On March 29, 1879, the *Java Bode* published a report on an earthquake that had struck Batavia and Buitenzorg the previous day. The article highlighted that the earthquake caused significant damage in Batavia. Meanwhile, reports from Buitenzorg indicated that the region experienced several tremors. The newspaper also mentioned the confusion surrounding the news of this earthquake. Journalists expressed their frustrations, particularly for the ab-

sence of geologists in Batavia, which hindered their ability to provide precise and accurate information about the seismic event ("Nederlandsch-Indie/Aardbeving," 1879).

On the same day, the *Bataviasche Handelsblad* covered the earthquake, providing a more precise timeline: the tremors were felt at 7 and 8 pm, and again at 2 am the next day. The coverage in this newspaper took two distinct forms; a chronological account with detailed descriptions and metaphors to convey the intensity of the vibrations, and an opinion piece by an anonymous writer. This article introduced a local belief that the earth was carried on the back of a buffalo, which, when overburdened, shook its body to alleviate the weight, metaphorically explaining the cause of the earthquake ("Indisch Mailoverzicht," 1879).

The author of the opinion piece in the *Bataviasche Handelsblad* proposed an allegorical interpretation of the earthquake. They suggested that the intensity of the recent seismic event reflected the current political climate. The earthquake, they argued, was not only a result of the subterranean pressures but also intense political pressures exerted on the surface. They likened these 'surface pressures' to the political shifts towards a more liberal stance in the Netherlands. This metaphorical analysis drew parallels between natural disasters originating from geological forces and political events acting as power upon society. Expressing their thoughts with a touch of cynicism, the author concluded the article by remarking on the aftermath of the earthquake. They noted that, despite the widespread infrastructural destruction, those subject to building tax had fortunately remained intact and the collection proceeded.

Bergsma's annual report on earthquakes and volcanic eruptions, published in 1882, offers a more systematic approach to documenting these natural phenomena (Bergsma, 1882). This comprehensive synthesis was based on reports submitted by regional heads, a practice initiated in 1860 (Reiche, 1863, pp. 108–109). These officials were required to report any seismic or volcanic activities in their jurisdictions. While newspaper accounts remained an important source for descriptions, the official reports provided crucial data on the geographical distribution of the areas affected by the earthquake from March 28 to 31, 1879.

Bergsma reported that the earthquake affected seven residencies and sixteen cities. The areas included Cianjur, Sukabumi, Bandung, Sumedang (Priangan), Meester Cornelis, Batavia, Buitenzorg (Batavia), Serang, Anyer, Pandeglang, Rangkasbi-

**Table 1.** Earthquake in West Java during the first half of the nineteenth century

No.	Location	Date	Time
1.	Buitenzorg	6 December 1810	7.30 pm
2.	Batavia and Buitenzorg	19 March 1812	00.00 am
3.	Buitenzorg	14 October 1812	11.00 am
4.	Buitenzorg	9 September 1823	08.00am
5.	Batavia	31 October 1831	02.00 pm
6.	Batavia	28 January 1833	12.00 am
7.	Batavia, Banten, Karawang, Buitenzorg, Priangan, and Mega Mendung	10 October 1833	06.30 am
8.	Batavia	18 June 1842	Morning
9.	Buitenzorg	25 May 1843	07.00 am
10.	Cianjur	15 February 1844	
11.	West Java	6 March 1845	
12.	Batavia and Buitenzorg	3 October 1846	
13.	Batavia	28 October 1847	
14.	West Java	16 Novembre 1847	10.00 am
15.	West Java	2 September 1848	04.00 am

tung (Banten), Teluk Betong (Lampung), Purwakarta (Karawang), Cirebon, Indramayu (Cirebon), and Tegal (Tegal). The report specifically addresses the events of October 28, noting that the seismic vibrations occurred twice. The first, a lighter tremor, was felt around 7:30 in the evening, while a second, much stronger quake occurred around 8:30. The reported timings varied from different cities; nevertheless, the range between the first and the second tremor occurred within that one-hour timeframe. This variation in reporting times across the affected cities indicates the extensive reach of the earthquake. The report also highlighted that Cianjur suffered the most severe damage, marking it as the epicenter of the strongest impact.

In Cianjur, the devastation was profound, as reported by local sources. Nearly all buildings were heavily shattered, including the prison. As a result, the 156 inmates were temporarily housed in tightly secured bamboo-made detention facilities. The Regent's home also collapsed, resulting in serious injuries to both the Regent and his wife. Furthermore, the local telegraph office and the mosque, which had become a shelter for victims during the quake, were also damaged. People who had gathered there to pray were caught in the destruction, leading to the death of the leader and several others. This calamity was captured in the *Batavia Handelsblad* on April 1, 1879, which reported:

All country buildings there were severely damaged and evacuated. The prison is beyond repair; the necessary steps were immediately taken to erect a temporary building. The prisoners were

provisionally transferred to the auxiliary prison in the name of the 28th. The salt warehouse and the fire engine houses have fallen into ruins. The telegraph office was badly damaged; outbuildings and furniture were destroyed. The postkommies was injured. Two mail sheds fell; however, the horses were retained. Some European and Chinese pipes collapsed and almost all houses were badly damaged. The bridge of Tjisokkan and other stone bridges suffered more or less damage. Soekaboemi and Sindanglaya had suffered nothing. Many persons, the regent, were hurt and seven, the chief panghoelu, perished (“Nederlandsch-Indie,” 1879).

For fifty years, during the first half of the nineteenth century, West Java experienced fifteen recorded earthquakes as can be seen in the table 1. While some seismic events were linked to volcanic activity, others were excluded from any volcanic phenomena. The intensity of these earthquakes varied significantly, ranging from mild tremors to strong quakes that caused notable rumbling. On September 9, 1823, at 8 in the morning, an earthquake in Buitenzorg was felt as far away as Cirebon. The tremors were so forceful that they caused people to assemble in alarm and the rising seawater by one foot. Another major earthquake struck Batavia on October 10, 1833, at 6:30 in the morning. With a rumbling sound from underground, it instilled fear among the people. This quake, which was also felt in Banten, Karawang, Buitenzorg, Priangan, and Mega Mendung, caused substantial destruction, particularly in Cianjur and Buitenzorg. Additionally, on November 16, 1847, at 10 in the morning, a

sizeable convulsion occurred in West Java. Initially reported in Batavia, it was soon discovered that this earthquake affected almost the entire region with Cirebon and Indramayu experiencing severe damage. Following the disaster, a reporter traveled through the affected regions to document the extent of the destruction (Reiche, 1859; Versteeg, 1859; Weitzel, 1859). Reiche, Versteeg, and Weitzel, all of whom were naturalists, compiled newspaper reports that concluded Cianjur's frequent encounters with earthquakes and volcanic eruptions until the mid-nineteenth century. This series of events, marked by consistent environmental challenges, ultimately led to the administrative move from Cianjur to Bandung.

At the dawn of the twentieth century, a noteworthy earthquake struck Sukabumi on January 14. The *Batavia Nieuwsblad* on January 15, 1900, reported that it occurred at 11:20 in the evening. The news detailed that the Victoria Hotel and the Selabatu Health Estate suffered partial destruction, with approximately forty-five houses collapsing. Notably, the earthquake, which was said to have lasted for thirty minutes, inflicted damage on railway lines, particularly those between Parungkuda and Cianjur. Additionally, landslides were reported in various locations, and many residences were abandoned in the aftermath. The newspaper further noted that tremors continued to January 15, indicating the prolonged nature of this seismic activity ("Nederlandsch Indie/ De Aardbeving," 1900).

The earthquake was not an abrupt occurrence. The *Batavia Nieuwsblad* included a report based on telephone communications from individuals at the epicenter of the disaster. These accounts revealed that:

more or less severe earthquake shocks had been observed day after day since the 4th of this day - which were even of such a nature that several people were driven to leave the place - they were startled that night around half past twelve o'clock by two extremely violent shocks that shook and cracked the strongest buildings and drove people into the streets in great fear. At intervals, the two shocks were followed by other lighter ones, which further aggravated the unrest. There was constant fear that even heavier shocks would follow and that the place would be completely destroyed. Fortunately, those fears did not materialize ("Aardbeving Te Soekaboemi," 1900).

Additional evidence about the earthquake's onset comes from the annual report on earthquakes and volcanic eruptions by the Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia for the

year 1900 (Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia, 1902). This report cites the earliest notification of seismic activity in Sukabumi, dating back to January 4, as reported by a resident named R. H. Klein. Following Klein's report, J. de Koning Kniff also confirmed similar tremors on the next day. Both accounts specified that multiple tremors were felt on January 4, and a notably strong tremor occurred on January 5. These early reports were gathered based on the testimonies of members of the Aardbevingcomissie, who were stationed across the Dutch East Indies. Given the frequency of tremors reported before January 14, the occurrence of the large earthquake on that day might not seem unexpected. Still, the event caused widespread shock and panic that many people were so alarmed by the intensity of the quake that they hastily evacuated their homes.

In response to the panic and the need for accurate information, an anonymous telegram message reached the editorial team of *Batavia Nieuwsblad* on January 15. The message read:

It is very striking that no daily newspaper has yet reported the fact that in Soekaboemi, for more than ten days now, terrible earthquakes have been felt intermittently, sometimes 6 to 10 times in one day, and dull sounds are heard; so disturbing that residents of stone houses have already had to leave those houses temporarily or have taken precautionary measures; while the cause of this very striking phenomenon has not yet been explained ("Aardbeving Te Soekaboemi," 1900).

The newspaper's policy, however, was to report events that had already occurred. The editor emphasized that it was not within their practice to speculate or write about incidents before they happened.

West Java was a hotspot for volcanic eruptions and earthquakes throughout the nineteenth century. The three major volcanic eruptions in the first half of the century, followed by two significant earthquakes towards its end, constituted major calamities for the region. These persistent and severe natural events have prompted the colonial government to consider new technology for more accurate and timely earthquake detection and analysis.

## RESEARCH ON EARTHQUAKES AND VOLCANOES

The European perspective consistently perceives volcanoes as a significant threat due to their destructive power. On a broader scale, volcanic eruptions posed a risk to economic stability, as they



could disrupt the production and circulation of commodities. Despite these concerns, the colonial government did not demonstrate a serious commitment to the comprehensive study and understanding of volcanoes. This lack of thorough investigation into volcanic activities was addressed during a meeting of the Geologisch-Mijnbouwkundig Genootschap voor Nederland en Kolonien on October 15, 1915, in Batavia. At this gathering, Ir. N. Wing Easton presented a lecture titled 'Wat wij van onze Indische vulkanen weten en niet weten' that served as a catalyst for a deeper reflection on the necessity of conducting more extensive volcanic research in the Dutch East Indies (Hövig, 1919a; Easton, 1929, pp. 83–84; Ruiter, 2016, p. 179).

Three years after Easton's pivotal lecture, P. Hovig took a significant step to further the cause of volcanology in the Dutch East Indies. On June 25, 1918, Hovig sent a letter to the board of the Koninklijk Natuurkundige Vereeniging (KNV) where he articulated his vision for the field:

the purpose of this letter is to make some proposals to the Board of the Royal Physicists' Association with the intention of arousing interest in the study of volcanology in these regions, of promoting this study itself on a scientific basis and of systematically implementing it, in such a way that the Dutch East Indies will one day take the place in this branch of science that it is, so to speak, naturally assigned to it (Hövig, 1919b, p. 94).

Aligning with Easton's viewpoints, he elaborates that volcanic research should encompass scientific inquiry and practical application. He emphasizes that scientific study of volcanoes would invariably lead to practical benefits. Specifically, he states that such research would be crucial for "of monitoring the volcanoes to prevent, or at least reduce, disasters resulting from volcanic activity."

Hovig's proposal was brought to the forefront during the KNV's monthly meeting on July 8, 1918, where it garnered attention from the management (Koninklijke Natuurkundige Vereeniging, 1919a). In the same meeting, Dr. Escher, a KNV member, proposed a preliminary plan for a volcanology research committee. This draft was slated for discussion at the following month's meeting (Escher, 1919). Consequently, the establishment of the committee was discussed at the KNV gathering on August 5, 1918, (Koninklijke Natuurkundige Vereeniging, 1919b). The leadership and members of the KNV unanimously recognized the significance of forming a volcanology committee resulting in an instruction to "devise plans for a systematic

study of our volcanoes". The instruction was further detailed in a letter from the Board of the KNV to H.E. the Governor-General dated December 9, 1918, under reference No. 1752, "to draw up a clearly defined work plan with a cost estimate, with the aim of achieving well-organized study and forest conservation of the volcanoes in our Archipelago" (Visser, 1921b, p. 159). The committee, however, was dismissed earlier than expected, but research into volcanoes did not cease. It became more systematic, particularly following the establishment of the Vulkanbewakingdienst, also known as the Vulkanologische Dienst, on September 14, 1920. This specialized service marked a significant step forward in volcanic research within the region. They conducted observations and monitoring as well as dissemination of their findings through a dedicated publication, the *Vulkanologische en Seismologische Mededeelingen*, first issued in 1921 (Ruiter, 2016, p. 179).

The institutionalization of the study underscored the colonial government's commitment to understanding volcanoes. This initiative aimed at advancing scientific knowledge, positioning the Dutch East Indies as a leader in volcanology. It also had practical implications in reducing the damage caused by volcanic eruptions. The establishment of this institution signified a shift from a reactive approach—where research and analysis were typically conducted in response to eruptions—to a proactive stance. Volcano research and continuous monitoring became standard practices, enhancing the understanding of volcanic activities. Significantly, this approach also involved the participation of people living in the vicinity of volcanoes.

In 1884, following the catastrophic eruption of Krakatoa, a committee was established to investigate earthquakes. This initiative directly responded to the need for more comprehensive seismic data. The committee's methodology relied heavily on a reporting system that engaged a broad network of people. Correspondence with collaborators from various regions across the Indies indicated the involvement of 549 individuals. Through the expansion of the pool of reporters, from 1884 onwards, earthquake reporting shifted from being predominantly based on newspaper accounts and communications from Residents to submissions from these widespread collaborators (Koninklijke Natuurkundige Vereeniging, 1886).

The method of earthquake reporting by individuals employed by the committee had inherent limitations. One significant issue was the varying sensitivity of reporters to seismic activity, leading to

discrepancies in the reports from different people. This variability was highlighted by H. Onnen, an editor of *Natuurkundig Tijdschrift* and a member of the Aardbevingcommissie, in his article “Gevoeligheid van verschillende personen voor aardbevingen” (Onnen, 1887; see also Jaelani, 2019, pp. 42–43). This challenge was particularly pronounced when seismograph technology was still unavailable in the Indies. However, the situation began to evolve at the start of the twentieth century.

S. W. Visser noted a pivotal development in seismic observation. In December 1908, a sensitive Wiechert seismograph featuring an inertial mass of 1,000 kilograms was installed at the Observatory in Batavia. Subsequently, in July 1911, a less sensitive instrument, with an inertial mass of 100 kilograms, was installed at the enterprise Malabar in Priangan, overseen by the Chief Administrator, K. A. R. Bosscha, whose name was later commemorated in the most famous observatory in Bandung. With these instruments, Visser conducted an in-depth analysis of the seismic activities in West Java, culminating in a publication in 1920. Significantly, this method marked a shift from relying on human sensory accounts to utilizing instruments that accurately recorded the vibrations (Visser, 1920).

The high sensitivity of the seismographic equipment enabled the detection of even the most subtle seismic vibrations, resulting in a substantial increase in recorded earthquake incidents. Over approximately ten years, seismograph recordings from the two locations, Batavia and Malabar, indicated a total of 987 vibrations—768 in Batavia and 219 in Malabar. Notably, in Batavia, of these recorded instances, only 333 were perceptible to human senses (Visser, 1920, p. 182). This discrepancy highlights the instrument's ability to detect tremors more accurately. The Malabar recordings, made with a different instrument, do not differentiate between vibrations that were felt and those that were not, due to the equipment's varied sensitivity.

Visser's research into the distribution of earthquakes in West Java stands as a significant contribution to the field. He engaged with the work of the French researcher M. De Montessus de Ballore, whose findings were also cited in Visser's study. Importantly, Visser offered a critical reassessment of de Ballore's conclusion that earthquakes originated from land. Visser's investigations led him to a different conclusion, as he stated, “precisely the southern coast must be rich in earthquakes, and that the epicenters are located on the submarine slope.” (Visser, 1920, p. 200). Expanding upon his earlier findings, Visser noticed that earth-

quake origins could be traced much deeper than previously thought, extending down to depths of approximately six hundred kilometers underground (Visser, 1921a). This was a significant departure from the earlier geological belief that earthquakes were primarily caused by shallow sources or were directly linked to volcanic activity (Bobbette, 2023, p. 33).

Visser's findings marked a paradigm shift in the understanding of earthquakes. Central to this advancement was the use of instruments capable of accurately recording seismic events, moving away from reliance on individual testimonies. Visser's work advanced the understanding of seismic phenomena and paved the way for more frequent and rigorous research into volcanoes. It is important to note that the establishment of specialized committees and the undertaking of more advanced, intensive research efforts effectively transformed West Java into a pivotal laboratory for geological and vulcanological studies.

## CONCLUSION

Throughout the nineteenth century, the West Java region endured a series of earthquakes and volcanic eruptions, marking it as a zone of significant geological activities. While the 1883 Krakatoa eruption stands out for its global impact, the region also witnessed notable eruptions from Mount Guntur, Galunggung, and Gede. Among these, the 1822 eruption of Mount Galunggung was particularly devastating, resulting in extensive casualties and material damage. In addition to the devastating human toll, these volcanic eruptions inflicted significant damage to the region's coffee plantations, a vital colonial economic resource. The repercussions of these events extended beyond immediate physical destruction, affecting the economic stability of the area. Moreover, West Java also experienced significant seismic events, notably the 1879 Cianjur earthquake, which led to widespread destruction in the city, and the 1900 Sukabumi earthquake.

Cianjur, as the former capital of the Priangan Residency, has historically been prone to earthquakes, leading to recurrent physical damage within the city. This consistent damage is often cited as a key factor in the decision to relocate the capital from Cianjur to Bandung. However, an in-depth review of disaster incident reports reveals an intriguing detail that there was no singular major disaster event immediately preceded the capital's displacement. Furthermore, a review of governmental documents on the relocation of the capital yields another significant observation that no explicit

mention or indication was found on the disaster ground for moving the capital.

Research into earthquakes and volcanic eruptions primarily aims to understand these natural phenomena, which are often seen as threats to economic and political stability. In times when knowledge and technology were limited, the primary method of research involved recording instances of earthquakes and volcanic eruptions. Through such documentation, it became possible to create maps and develop a better understanding of disaster incidents. In the event of a volcanic eruption, field research was often conducted to examine the volcano's morphology post-eruption. With the development of geology and volcanology as sciences and technological advancements, the approach to earthquake research evolved. It transitioned from relying on individual testimonial reports to utilizing seismograph recordings, which offered more precise and objective data. A significant breakthrough in earthquake research was the identification of earthquake epicenters deep in the southern Indian Ocean. This discovery reshaped previous understandings of seismic activity origins. Concurrently, research on volcanoes has evolved from a reactive to a more proactive stance. Today continuous monitoring of volcanic activities has become a key focus, allowing for better and earlier response to potential volcanic events.

Systematic research into earthquakes and volcanoes was conducted in parallel with the expanding power of the colonial state. As the number of Europeans in the region grew, so did their interests. This demographic and economic shift played a significant role in driving the intensity and focus of the scientific studies related to these natural phenomena. Consequently, enhancing security measures became a crucial priority. This aspect underlines a recurring theme in the study: the dual importance of earthquake and volcano research, both scientifically and practically. The scientific interest lies in the deepened understanding of these natural phenomena, while the practical aspect focuses on preventing or minimizing the extensive damage caused by such disasters.

#### ACKNOWLEDGMENTS

The research for this article is funded by the Indonesian National Higher Education Research Grant (Bima Dikti)-Fundamental Research Scheme 2023.

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