Chapter Two

Of Tremors and Collapsing Wells: When Science Goes Public

1. Introduction

This chapter attempts to present a scientific controversy that erupted in the scientific public sphere when an earthquake of low intensity occurred in Kerala on 12 December 2000. Many tremors of lower intensity continued striking the region from then on and the controversy acquired multiple dimensions. The issue intensified after the Gujarat earthquake on 26 January 2001 when reports appeared in the press linking it with the tremors in Kerala. The second phase of the controversy erupted when several unusual geological events occurred in the region. Well collapses, oscillations in water level, colour change of water in wells, cracks in buildings, ground fissures and so on were reported from various parts of Kerala. The newspapers reported similar incidents from every nook and corner of the state, with diverse and often contradictory scientific explanations proposed. This chapter, therefore, attempts to describe the contingencies and ambivalences of 'science-in-the-making' (Michael 2002: 118) unfolding before the public. The chapter focuses on content analysis of the news reports on the controversy, thereby portraying the deliberations on the front stage of the scientific public sphere.

2. The Outbreak of the 'Earthquake Controversy'

The controversy erupted against the background of an earthquake of medium intensity that occurred in nine districts of Kerala at around 6.54 am and a second one at 8.20 am on 12 December 2000,1 as reported by newspapers the next day. All the five newspapers carried the news as their headlines. The newspapers provided a wide range of scientific perspectives and information on the tremors from the very first day. Their reliance on various sources of scientific information and the portrayal of these sources as being opposed to each other were central to the creation of the scientific controversy.

The debates of the day were mainly around three issues. The first was a polemic regarding the magnitude and epicentre of the quake. Scientists from the

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Centre for Earth Science Studies (CESS)\(^2\) argued that the tremor was of an intensity of five on the Richter scale, and suggested Painavu, the district headquarters of Idukki, as the epicentre. On the other hand, the Kerala State Electricity Board (KSEB)'s geological research wing argued that the tremor was of a lower magnitude of 3.35, and according to them the epicentre was Melukavu, a hill station in Kottayam district. A second issue that cropped-up was the idea that reservoirs induce earthquakes. Most of the newspapers presented this argument citing scientific papers and quoting different scientists. The issue acquired importance because Idukki district is the most 'dammed' district in the state\(^3\) and as suggested by the CESS scientists, the epicentre was Painavu, where Idukki dam, the major dam in the state is located. A third issue related to the controversy was the impact of the tremors on the dams. The foci of the dispute were the Mullaperiyar Dam, which was built in the colonial period, and the Idukki arch dam which is considered as a modern engineering marvel. These three points were the axes of public controversy in the consecutive days.

2.1. The Controversy Concerning the Epicentre and Intensity of the Earthquake

When the disagreements in deciding the epicentre and magnitude of the earthquake appeared in the press, the scientific public sphere became dynamic with the involvement of a wide array of actors. Newspapers turned to be active participants in the deliberation, criticising the scientific community for lack of consensus and eliminating scientific uncertainties. Newspapers like the \textit{Mathrubhumi} strongly critiqued the contradictions in the findings of the CESS and the KSEB in the context of a second set of low-intensity tremors that shook the region on 13 December.\(^4\) They highlighted the ambiguities in the CESS scientists' argument that no major earthquake would occur in Kerala. The \textit{Madhyamam} argued that Kerala had become prone to earthquakes, contrasting the findings from the investigations of the Department of Mining and Geology (DMG) against the former.\(^5\)

\(^2\) The CESS is an autonomous research centre instituted by the Government of Kerala in 1978, and is situated in Akkulam, Thiruvananthapuram. The centre carries out research in different areas of earth systems studies from a multidisciplinary perspective, including studies on paleomagnetism, natural hazards, coastal zone management and use of resource studies for local planning.


In this context, the CESS and the geological research wing of KSEB, the two adversaries in the controversy, defended their respective claims using different strategies. The CESS scientists began investigations on 14th December in Painavu in order to determine the epicentre with greater precision. The KSEB, on the other hand, assisted the expert team from the Indian Meteorological Department (IMD). Although the expert team from IMD began their investigation at Melukavu, the epicentre according to the KSEB, it is quite interesting to see that they never made their association with the KSEB explicit. They argued that their objective was to decide the epicentre accurately by taking into consideration both arguments. In a display of impartiality and upholding 'scientific objectivity', they visited Painavu also. They even suggested that the epicentre could be in between Melukavu and Painavu—perhaps as a national institute, they saw themselves playing the role of an adjudicating authority.

The Mathrubhumi attempted to play-up the dispute at this juncture by alleging that the KSEB’s findings were based on data obtained from only four out of its twelve seismic stations. This happened the newspaper claimed, quoting the KSEB officials, because of a national strike observed by the KSEB employees on 12th December. The newspaper was apparently trying to cash in on the mounting public disapproval of political strikes and hartals, another debate that intermittently erupts in the regional press. However, this attempt was turned down by the KSEB Workers’ Association (CITU) with the support of the Deshabhimani, pointing out that in spite of the strike, the engineers collected the accelerograph readings from all centres and calculated the

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6 Hereafter, it will be mentioned as ‘KSEB’.
8 The expert team had B.S. Rane, Asst. Meteorologist and M. Jayagopal, Senior Scientific Assistant, as members.
9 “Bhoochalanam: Kendrabindu Melukavinum Painavinum Madhye Akanida”, M, 16.12.2000, p.5. However, their close association with the KSEB was noted by Kerala Kaumudi and Deshabhimani, although in an uncritical manner. The Deshabhimani reported that the expert team had been received at the airport by the KSEB research wing director K.R. Gopalakrishnan. Kerala Kaumudi reported that the expert team was invited by the KSEB. See “Bhoochalanam Mullaperiyar Damil Vilalukal Veezhthi”, KK, 16.12.2000, p.1; “Bhoochalanam: Kendra Sanghom Ethi, Pradhamika Padana Report Randazchhaytkulil”, D, 15.12.2000, p.5.
12 It should be noted that Deshabhimani is the official organ of the Kerala CPI(M), and the CITU is the trade union of the same political party.
magnitude as well as the epicentre, and criticised the ulterior motives of the newspaper.

The tremors continued in the region after the earthquake of 12 December, and so did the dispute. The feud between the CESS and the KSEB intensified when the spokespersons of the institutions appeared with more evidence in support of their respective claims and they sought the help of other scientific institutions at this juncture. The Meteorological Centre at Thiruvananthapuram supported the CESS. The Geological Survey of India (GSI) entered the controversy by sending a research team for further investigations. The DMG submitted its scientific report to the State Government stating that the intensity was 3.5, supporting the KSEB’s claim. The National Geophysical Research Institute, Hyderabad argued that according to the calculations based on their recordings the intensity was 4.9, an explanation more in conformity with the finding of the CESS. The research coalitions formed between the regional institutions and the scientifically more ‘powerful’ national institutions helped them to acquire more scientific authority for their respective claims, thereby regaining the public trust that was eroding away since the outbreak of the controversy.

2.2. Reservoir Induced Seismicity: Idukki as a Potential Threat

Another controversy running parallel to and tightly woven with the intensity-epicentre controversy is cardinal to understanding the dynamics of the scientific public sphere: the controversy over the argument that reservoirs can trigger earthquakes. From the very first day, serious questions concerning the role of reservoirs in the Idukki district in inducing seismic activity in the region had been raised in the regional press. This concern acquired much importance in the following days, when the newspapers began to publish more journalistic reports on the subject, drawing on different sources. As mentioned earlier, Idukki district has several dams located within a very small geographical area and this was cause for alarm. The

14 Ibid.
18 Ibid.
19 All newspapers except the Deshabhimani highlighted the issue on the first day itself. The Deshabhimani seemingly kept quiet about the issue, as it was the CPI (M) led Left Democratic Front.
argument of the CESS that the epicentre was Painavu, the location of the huge reservoir of the Idukki Hydro Power Project, further reinforced the fear that the earthquake in the region was induced by reservoirs. The Malayala Manorama suggested in this context the collapse of ‘the long-standing belief of scientists’ that Kerala was located in the safer South Indian Shield and therefore, less prone to major earthquakes.\textsuperscript{20} The newspaper discussed the pros and cons of the Reservoir Induced Seismicity (RIS) argument.\textsuperscript{21} The Kerala Kaumudi supported the RIS thesis while reporting the small tremors which continued to occur at the Idukki dam site.\textsuperscript{22} The Madhyamam quoted scientists from the CESS to hint that the Idukki dam could be the immediate trigger for the earthquake.\textsuperscript{23} It published three major journalistic reports which examined the role of the Idukki dam in inducing earthquakes.\textsuperscript{24} The newspaper took a pro-RIS stance and quoted existing studies and interviewed reputed scientists to drive home the point. The newspapers in general also suggested the possible threat of bursting of dam due to increased seismic activity in the area.

The argument of the scientists from the CESS regarding the epicentre and magnitude of the earthquake might have contributed to the commencement of the RIS controversy in the scientific public sphere. Gradually they realised that the RIS hypothesis would prove troublesome for them. The claim regarding the role of the Idukki dam in rendering the region earthquake prone was very much in the air since day one, and questions regarding the potential threat to the Idukki dam in likelihood of another earthquake were raised.\textsuperscript{25} The CESS scientists who primarily suggested that the vicinity of the Idukki Dam was the epicentre thus faced an unanticipated dilemma. In order to resolve it, they had to emphasise that the dam would not be affected by earthquakes, pointing out the modern engineering of the dam and the

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\textsuperscript{21} Ibid.


\textsuperscript{25} Apparently journalists asked them difficult questions about the RIS with reference to the Idukki reservoir in press conferences and interviews.
tectonic study that had been undertaken before building the dam. They slightly modified their argument with the intention of shifting the debate to another dam at Mullaperiyar, which had been an eye sore for Kerala for quite some time. The scientists pointed out that the earthquakes must have damaged Mullaperiyar, the oldest dam in Kerala built using pre-modern technology. While the CESS scientists were trying hard to transfer the RIS debate to the context of the Mullaperiyar dam in order to divert attention from the Idukki dam, interestingly, the same objective had already been accomplished by the KSEB scientists who located the epicentre at Melukavu in Kottayam district, a place quite far from the Idukki Dam. The argument that the magnitude of the earthquake was lower further served their purpose. As scientists in the KSEB responsible for answering any questions regarding the safety of Idukki dam, they possibly anticipated the problem much ahead of the CESS scientists, and therefore vigorously defended their ‘oppositional’ findings.

Even after the Mullaperiyar issue developed as a major debate, the public fear about the Idukki dam persisted. In its editorial on 14 December, the Madhyamam challenged the assumptions of the CESS scientists for trivialising the possible threat of the Idukki dam. The editorial pointed out that the statements of the scientists were not based on thorough research. The newspaper also suggested that the scientists could not be relied upon due to inconsistencies in their scientific explanations, pointing out the difference of opinion that existed among them regarding the epicentre and the magnitude of the earthquake. The editorial cited studies supporting the RIS hypothesis and pointed out the cracks that developed in the Koyna Dam site following the earthquake of 1967 as solid evidence. The newspaper critiqued the anti-people

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27 The debate on the possible threat raised by the Mullaperiyar dam deserves more attention as it is an ongoing debate interlinked to the inter-state politics between Tamil Nadu and Kerala. The issue will be discussed in detail in the next section.
30 Ibid.
31 The Koyna dam was built in Maharashtra in 1962, and a major earthquake of a magnitude of seven occurred at the dam site (Koyna Nagar) on 11 December 1967. The earthquake partially destroyed the dam as cracks appeared on it. Many geologists believe that the earthquake was induced by the reservoir. For a detailed study, see Adrienne Catone-Huber and Jennifer Smith (not dated). “1967 Earthquake at Koyna Dam, India: The Study of a Reservoir-Induced Earthquake”. http://www.hubcat.org/Adrienne/Koyna/Koyna_home.htm, accessed on 19.01.2007.
and anti-environmental developmentalism in India that supported building big reservoirs even in ecologically and seismically sensitive areas like the Himalayan region.\(^{32}\) The *Mathrubhumi* too took a similar position, arguing that big dams were products of the unholy alliance between politicians, bureaucrats and contractors.\(^{33}\) The newspaper pointed out that there were no scientific studies available on RIS in Kerala,\(^{34}\) and drew attention to the risk posed by the Idukki dam, suggesting that since 1974 there had been so many dam-induced tremors near the catchment area.\(^{35}\) The *Mathrubhumi* refuted the argument of scientists that reservoir-induced tremors would come to an end a few years after the dam was constructed and insisted on rethinking the developmentalist ideas on which the construction of big dams had been justified and legitimised.\(^{36}\) The newspaper also contended that scientists in Kerala were forced to be silent on the issue of RIS, pointing a finger to the relationship between politicians, bureaucrats, and contractors that impeded further scientific research on RIS in Kerala.\(^{37}\) *Mathrubhumi* seriously pushed their argument on RIS into the scientific public sphere in the consecutive days. The newspaper highlighted the problem of ecological risk in support of its opposition to big dams, but the Mullaperiyar dam was also addressed, without reducing the importance of the critique of big dams.\(^{38}\) This emphasis on the ecological risk posed by big dams was carefully presented by the newspapers, linking the issue of tremors with the ecological and anti-developmentalist concerns that crystallised through a long deliberative process commencing in the late 1970s and 1980s.\(^{39}\)

\(^{32}\) Big dam projects like the Tehri and Vishnuprayag were in the Himalayas, the editorial pointed out. See “Bhoochalanam Oru Munnariyippu”, *M*, 14.12.2000, p.4, editorial.


\(^{34}\) Ibid.

\(^{35}\) Ibid.

\(^{36}\) Ibid.

\(^{37}\) Ibid.


\(^{39}\) See chapter 1. The newspapers quite often use different ‘discourse frames’ to situate and emphasise issues and arguments. See chapter 5 for a detailed discussion on this narrative strategy.
2.3. Attaining Closure

The controversies regarding the epicentre and magnitude of the earthquake as well as the debate on whether reservoirs induce seismic activity reached closure\textsuperscript{40} when Dr. B.K. Rastogi, the assistant director of the National Geophysical Research Institute (NGRI, Hyderabad) visited the earthquake-affected districts.\textsuperscript{41} As a reputed scientist from a national scientific institution, his intervention had greater acceptance in the scientific public sphere and he was considered as a supra-scientific authority capable of settling the dispute. He opined that the occurrence of a big earthquake in Kerala was unlikely although micro-seismic activity might continue for a couple of months.\textsuperscript{42} He asserted that the earthquake did not affect the Idukki dam, and said that he was not sure about its impact on the Mullaperiyar dam.\textsuperscript{43} He pointed out that the Idukki dam was only 24 years old and strong enough, but the latter was more than a century old and therefore weak.\textsuperscript{44} He also refuted the RIS argument by pointing to the absence of scientific research that establishes a link between reservoirs and earthquakes.\textsuperscript{45} Rastogi made an effort to vindicate the Idukki dam by carefully shifting the site of the controversy to the Mullaperiyar dam.\textsuperscript{46} The research team of the Geological Survey of India also substantiated Rastogi’s exoneration of the Idukki dam late in their report to the state government.\textsuperscript{47}

Rastogi intervened in the epicentre-magnitude controversy as well. He declared that the intensity of the earthquake was five on the Richter scale,\textsuperscript{48} and

\textsuperscript{40}In most of the cases a scientific controversy attains ‘closure’ instead of resolution. Closure, as the term indicates, is a temporary, abrupt ending of the dispute. Although the scientific controversy disappears as a result of the closure, it can reappear and can have a second life. For detailed discussions on closure, see Engelhardt and Caplan, 1987.

\textsuperscript{41}Rastogi turned to be a big player in attaining closure by 18 of December. All newspapers have widely covered his statements, but even this was not going unopposed in the scientific public sphere. Mathrubhumi, the newspaper that strongly supported the RJS simply ignored Rastogi. The newspaper published a small, one column news item about his arrival on 17 December. See “Bhoochalanan Padikan Rastogi Ehti”, MB, 17.12.2000, p.13.


\textsuperscript{45}Ibid.


suggested that the discrepancy in the readings occurred because the CESS and the KSEB had used different formulae to calculate the magnitude.\textsuperscript{49} According to him, the KSEB was using the old, outdated formula and therefore new formula should be adopted after conducting further research in the area so that more accurate calculations would be possible.\textsuperscript{50} He also suggested that more sophisticated instruments must be installed at the KSEB research stations in order to get more accurate readings.\textsuperscript{51}

Though Rastogi’s statements may appear opposed to the claims of the KSEB in a quick reading, it was not actually so.\textsuperscript{52} It is clear that his conclusions were based on the data obtained from the KSEB’s seismographs in Idukki.\textsuperscript{53} Further, instead of supporting the argument of the CESS scientists, he was taking a nuanced position on the controversy. For instance, the issue of magnitude was resolved without criticising the KSEB researchers, but pointing out to the use of different formulas by the two research teams, and the lack of the latest scientific instrumentation at the KSEB research centre that were needed to make accurate recordings. Thus, by pointing out to the lack of infrastructure available to the KSEB scientists for pursuing ‘better science’ and by instigating the need for further scientific investigations, Rastogi endeavoured to reinstate the lost public trust in science by invoking the possibility of achieving an authentic, objective and accurate technoscientific solution to the problem. On the question of the epicentre, he carefully shifted the focus away from the Idukki dam. On one hand, he argued that the epicentre was thirty kilometres away from Painavu in the south-western direction and proposed that Erattupetta was the epicentre.\textsuperscript{54} This newly proposed epicentre was closer to Melukavu, the epicentre proposed by the KSEB scientists. On the other hand, he shifted attention away from the Idukki district while suggesting Palakkad as the most earthquake prone area in the region.\textsuperscript{55} These strategies in effect helped him neutralise the RIS argument against the

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\item[49] Ibid.
\item[51] “Keralathile Bhoochalananathinu 5 Muthal 8 Kilometre Vare Vegatha”, \textit{M}, 19.12.2000, p.10.
\item[52] We can see him moving around with the KSEB research team. See Ibid.
\item[53] Ibid.
\end{thebibliography}
Idukki dam. The intervention of Rastogi\(^{56}\) thereby actually helped the KSEB push its real concerns while seeking consensus at different levels. The timely and nuanced intervention of the ‘impartial third party scientist’ from outside the region with greater epistemic authority successfully enforced closure and transferred the focus of discussion to the Mullaperiyar dam issue.

2.4. Shifting the Focus: The Mullaperiyar Dam and Regional Politics

However, this was not the sole reason for shifting attention to the Mullaperiyar dam in the scientific public sphere. The Mullaperiyar dam issue has been a serious political controversy in the South India in its own right to date; the emphasis on the dam in the scientific public sphere was part of the wider political controversy raging between Kerala and Tamil Nadu on the question of the sharing of water.\(^{57}\) The negotiations over the Mullaperiyar dam in the scientific public sphere in the wake of the earthquake of 12 December 2000\(^{58}\) deserves attention as it helps us understand how regional politics play into the knowledge-production practices in science.

Although the debate veered toward the Mullaperiyar dam issue only in a later phase, the attempt from the very first day was to link the earthquake with the dam. And the forging of a coalition of different actors towards defending the interest of

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\(^{56}\) There is no assumption here that Dr. Rastogi was deliberately playing the game in his individual capacity. Dr. Rastogi has been constructed by the scientific public sphere, as his views were carefully mounted in the negotiations by the interplay of several actors.

\(^{57}\) The history of the Mullaperiyar dam goes back to the colonial period, as the dam was constructed in 1895 using lime and mortar with the help of the British Army Engineering Corps. The dam was built as a result of the agreement between the Maharaja of the princely state of Travencore and the Madras government to divert the water in the Periyar River partly to the rain shadow affected districts of the neighbouring Madras province. The agreement was to share water on lease for 999 years. The pact continued in that form for a long time and was even renewed in 1970 unconditionally, but uneasiness about this agreement with Tamil Nadu developed in Kerala into a major issue since the building of the Idukki dam in 1960, thirty kilometres down stream. The new dam was conceived as a hydroelectric power project to provide electricity to Kerala, and the expectation was that the catchment area would be filled during the monsoon months. However, as time passed the dam failed to fill up and it affected power generation. It became a necessity at this juncture to allow more water to reach Idukki dam and Mullaperiyar dam up stream turned to be a hindrance for the same. This has led to a long-lasting dispute between Tamil Nadu and Kerala regarding the treaty on the Mullaperiyar dam. Kerala wanted the storage level of the dam to be brought down to 136 feet and the Tamil Nadu government agreed to the same in 1979. Since then, there has been much tug of war between Kerala and Tamil Nadu about raising the height of water storage in Mullaperiyar dam and the controversy achieved several new dimensions of late. In 1998, the Government of Tamil Nadu filed a petition in the Supreme Court seeking the rise of the water level to 152 feet. Kerala argued against this plea on security grounds, pointing out that the dam is more than a hundred years old. The issue turned to be a serious geopolitical controversy between the states and continues to date with added momentum.

\(^{58}\) Even the day before the first earthquake, there was an editorial page article in the Madhyamam about the environmental destruction the raising of the water storage level in the Mullaperiyar dam could cause. See Vinodkumar Damodar 2000. “Mullaperiyar, Kanathe Pokunna Parishithi Prasangal”, M, 12.12.2000, p.4.
Kerala was visible. The regional press, the regional scientists and the state government worked together towards highlighting the potential risk created by the age-old dam for the people of Kerala in the context of seismic activation of the zone. Many of the news reports that appeared on the first day endeavoured to link the threat of the earthquake to the dam with the Tamil Nadu government’s attempt to raise its height. The Deshabhimani argued that the Mullaperiyar dam was situated in the Idamalayar zone, a seismic zone that was very active, basing their claim on the authority of the CESS scientists. The newspaper also contended that no tectonic study was undertaken till date in the case of this dam, and any attempt to raise the water level without a study could prove disastrous. While only Deshabhimani emphasised the issue in the initial phase, all the newspapers joined the debate in the following days, taking a similar line of argument.

Though it was the KSEB scientists who attempted to create the link, gradually other research teams also joined them in support of the greater regional concern. The expert team of the Kerala Government visited the dam site on 15 December and discovered cracks in the dam and suggested that it could be due to the earthquake. The team suggested that even the permitted water storage level of 136 feet was not safe. The expert team also suggested that more scientific investigations were needed in the area to assess the vulnerability of the dam as well as the area, and declared their decision to conduct a detailed scientific study with the aid of the Indian Meteorological Department (IMD). As we have seen earlier in a different context,

59 “Mullaperiyar Dam: Uyaram Koottiyal Bhoochalanathinu Sadhyatha”, D, 13.12.2000, p.1. Although other newspapers shared the concern, they published similar reports only in the local pages.

60 Ibid. See also Mathrubhumi and Malayala Manorama of 13.12.2000 for similar reports.

61 It was the Left Democratic Front led by the CPI(M) that formed the government in Kerala in this period. It may be one of the reasons why the Deshabhimani highlighted the Mullaperiyar issue in favour of the government.


63 The team was led by Lalita Michel, the Chief Engineer of the Irrigation Dam Design Wing of the Irrigation Department, Kerala State.


65 Ibid.


the regional scientists attempted to establish research coalitions with national institutes, and this was crucial for safeguarding the interest of Kerala and to outweigh similar attempts made by Tamil Nadu and its scientists. As a result, the Department of Mining and Geology (DMG) came out in support of this argument when they submitted their scientific report to the state government. They discovered new cracks in the dam and suggested more collaborative research with other scientific institutions. They also pointed out that the dam area is earthquake prone and demanded the establishment of a seismic station in the area to conduct further investigations. The *Madhyamam* reported that scientists from the NGRI also discovered a crack at the base of the dam. The CESS slightly modified their epicentre argument at this juncture and suggested that the Mullaperiyar dam was within fifty kilometres of the epicentre.

Taking note of the gravity of the issue, Members of Parliament (MPs) from Kerala urged the union government to send a national expert team to visit the dam site. The newspapers raised an alarm about Tamil Nadu’s attempt to seal the cracks at this juncture. The Tamil Nadu government did not remain silent; the DMK under the leadership of Dorai Murukan, the then minister of Tamil Nadu, argued that the dam was not vulnerable. The expert team of scientists appointed by the Supreme Court to look into the matter adopted at this occasion a stand in favour of the Tamil Nadu government. M.K. Parameswaran, the sole representative of the Kerala government in the commission therefore came out against the majority opinion of the

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70 Ibid.
75 The Dravida Munnettra Kazhakam (DMK), a major political party in Tamil Nadu.
commission. He also demanded more detailed studies on the dam. When the situation worsened, the Kerala government assigned an expert committee for further investigation with Dr. M. Bava of the CESS as the coordinator. Interestingly, the Mullaperiyar dam had been an issue debated in the political realm, wherein Tamil Nadu was always victorious. But the translation of the whole dispute into the language of science through a long process of deliberation in the wake of the tremors helped Kerala to articulate its demands in a more impressive way. It is also notable that the government and the scientists were in a symbiotic relationship: when the scientists helped the state to legitimise its arguments, their association with the government helped the scientists to handle the scientific controversy in a more conducive manner.

As the developments show, it is quite clear that the negotiations in the scientific public sphere since the tremors gradually evolved towards a single point where a whole array of interests successfully converged: the Mullaperiyar Dam. The dam turned to be an 'obligatory passage point' for all the actors in the scientific public sphere (Callon 1986; Latour 1987, 1988). That is, all those who were involved in the deliberations articulated themselves with reference to the threat created by the dam. This alliance of the actors around the question (Callon 1986:206) of the dam further crystallised when a second earthquake struck Kerala on 7 January 2001. This time both the KSEB and the CESS scientists had approximately the same findings. The scientific lessons learned from the previous tremors and the negotiations in the scientific public sphere might have helped the scientists to localise the phenomenon more accurately, in a more consensual manner. The scientists from the CESS suggested Nadakkal, a place between Erattupetta and Theekkoi in the Kottayam


80 The strong influence of the state in national politics is a major reason for this. Regional parties like DMK and AIADMK (All India Anna Dravida Munnetra Kazhakam) are a powerful presence in national coalition politics.
district, as the epicentre.\textsuperscript{81} The magnitude according to the CESS scientists was 4.8 on the Richter scale. They also pointed out that the epicentre of the earthquake on 12 December also was at the same place, and therefore the latter was an aftershock of the former.\textsuperscript{82} The KSEB scientists suggested that the epicentre was of intensity five and near Peerumedu.\textsuperscript{83} The epicentre for both of them was at a safe distance away from the Idukki dam. The intensity was approximately five, strong enough to have an impact on the Mullaperiyar dam, but not the Idukki dam. The scientists from other institutions also corroborated the findings.\textsuperscript{84}

The consensus over the Mullaperiyar issue among an otherwise divided scientific community in Kerala became possible in a situation where the battle lines had been drawn in terms of regional interests. The new earthquake that was localised closer to the Mullaperiyar dam, augmented the demands of Kerala, and the tug of war between the states continued. Most of the newspapers reported the deepening of cracks in the dam structure in the wake of the earthquake.\textsuperscript{85} In this context, the \textit{Mathrubhumi} suggested the construction of a new dam on the Mullaperiyar in lieu of the old one.\textsuperscript{86} The \textit{Deshabhimani} quoted Dr. S.K. Srivastava, the then additional director general of the IMD, as well as Dr. K.R. Gopalakrishnan of the KSEB research wing, to suggest that the earthquake had a lethal impact on the dam as the epicentre was near the dam site.\textsuperscript{87} The newspaper also demanded reconsidering the decision taken by the expert committee in favour of Tamil Nadu to raise the water


\textsuperscript{82} "Veendum Shakthamaya Bhoochalanam, Palayidatham Nashanashtham", \textit{MM}, 08.01.2001, p.1, main news.

\textsuperscript{83} Peerumedu is closer to the Mullaperiyar dam.

\textsuperscript{84} The GSI team under the leadership of B.K. Sastri suggested the magnitude as 4.5 based on the data from the GSI's seismograph in Kulamavu. For them, the epicentre was between Erattupetta and Pala. According to the IMD, the intensity was 4.8 and for the NGRI it was 4.9. Dr. Rastogi also agreed with the GSI and the KSEB and was quoted by B.K Sastri in the press conference. See "Keralathil Veendum Bhoochalanam", \textit{D}, 08.01.2001, main news, p.1; "Prabhava Kendram Palaykkum Erattupettaykkum Idayil", \textit{M}, 09.01.2001, p.1; "Bhoochalana Kendram Erattupettyakkum Sameepam", \textit{MB}, 08.01.2001, p.5.


\textsuperscript{86} "Mullaperiyaril Puthiya Anakkettu Nirmikkanam", \textit{MB}, editorial, 09.01.2001, p.4.

\textsuperscript{87} "Mullaperiyar Damile Villal Valuthayi", \textit{D}, 08.01.2001, p.1.
level to 142 feet.\(^{88}\) In an editorial on the issue published a little later, the spectre of the RIS theory rose again and the scientific authority of Dr. Rastogi was cited to buttress the argument.\(^{89}\) The Department of Mining and Geology (DMG) of the state government came out at this juncture with the argument that the Mullaperiyar dam was situated on one of the most unstable fault lines in the region.\(^{90}\) In their report, the department urged the state government to take necessary steps to ensure the safety of the dam,\(^{91}\) arguing that the epicentre of the earthquake on 7 January was at Kondoor, a site that was closer to the dam than was the epicentre of the first earthquake. Based on this finding, they argued that the epicentre was gradually moving towards the dam.\(^{92}\) The expert committee appointed by the state government expressed the same opinion in its interim report.\(^{93}\) On the other hand, the Central Soil and Material Research Station (CSMRS), a national research institute, appeared to rule in favour of Tamil Nadu in their investigation of the water pressure exerted on the dam structure. Their recommendations to the committee appointed by the Ministry of Water Resources included raising the water level to 142 feet.\(^{94}\) Although the Kerala representative in the committee objected to this recommendation,\(^{95}\) the committee’s decision announced at its final meeting was in support of the demands of the Government of Tamil Nadu.\(^{96}\) However, the articulation of the scientific concerns of Kerala radically helped it to dissipate the previous consensus at the national level in favour of Tamil Nadu, and the committees decision was no way the ultimatum on the

\(^{88}\) Ibid.

\(^{89}\) “Mullaperiyar, Vivekan Vediyaruthu”, editorial, D, 09.01.2001, p. 4. *Madhyamam* attempted to bring in the RIS argument to suggest that the Idukki region was highly vulnerable to earthquakes due to the presence of several dams, quoting scientific agencies such as the DMG and the CESS. See P.K. Prakash, “Keralam Bhoomaap Sadyayatha Meghala, Geology Padanan Njetikkunnathu”, M, 08.01.2001, p.4.


\(^{91}\) Ibid.

\(^{92}\) Ibid.


\(^{94}\) “Keralathinte Vadathinu Melkai, Mullaperiyar Anthima Yogam Matti”, MM, 24.01.2001, p.11. *Malayala Manorama* alleged in another context, after the final report of the committee had been published, that the experiments performed by scientists from the CSMRS were ‘scientifically invalid’. The newspaper even described how the ‘pulse velocity test’ was conducted by the team in order to point out the drawbacks of the test. See Jacob K. Philip. “Anakkettu Apakadakaram, Dam Roopakalpana Chattangal Thanne Thelivu”, MM, 11.02.2001, p.1.

\(^{95}\) “Keralathinte Vadathinu Melkai, Mullaperiyar Anthima Yogam Matti”, MM, 24.01.2001, p.11.

matter. Thereafter, Kerala began strongly demanding the decommissioning of the dam and the construction of a new dam, which is now generally perceived as a possible way of resolving the dispute between the states.

3. Apocalypse Now: The Afterlife of a Controversy

Although there was an agreement voiced in the Malayalam press on the threat posed by the Mullaperiyar dam, the series of scientific controversies that originated in the wake of the first earthquake of 12 December 2000 did not come to an end. The tremor that struck the region on 7 January 2001 reinvigorated the deliberations and the anxiety about the impending catastrophe. The situation was aggravated when a major earthquake occurred in Gujarat on Friday, 26 January 2001. This section discusses the new controversies that surfaced in the scientific public sphere.

3.1. ‘Can Earthquakes be Predicted?’

The earthquake of 7 January 2001 raised the question of the seismic vulnerability of the region. The Malayala Manorama and Kerala Kaumudi reported that the scientific belief that the Indian subcontinent was less prone to big earthquakes had been proven wrong as recent studies of the tectonic structure of the zone revealed the presence of fault lines in the region. Dr. Srivastava of the IMD pointed out that the tremors seemingly indicated the appearance of new fault lines in Idukki zone. Mathrubhumi also argued that the second earthquake contradicted the earlier scientific explanation that strong tremors of the same magnitude would not occur for a second time in Kerala and emphasised the presence of fault lines. The newspaper quoted Dr. Rastogi as having suggested that new tremors may follow in the wake of the second earthquake. The Deshabhimani opined that the recurring tremors were an indication of the presence of a lineament that passed through the Idukki district and signalled the possibility of another earthquake. The Madhyamam evoked the RIS

97 ‘Fault lines’ and ‘Lineaments’ are used interchangeably in the regional press and therefore, we also use the terms as synonyms.
100 “Jithu Asadharaana Anubhavam”, MB, 08.01.2001, p.8.
argument quoting the DMG as we discussed earlier, and the Kerala Kaumudi noted the construction of several dams in Idukki district as a major cause of the recurrent tremors in the area.

In the consecutive days, fault lines became a key topic of discussion. The lineament theory received much attention in the debate and differences of opinion amongst the scientists concerning the possibility of a major earthquake in the region surfaced. The loss of trust in scientists was aggravated by the occurrence of repeated localised tremors in many parts of the state. The scientists continued arguing that those were nothing but ‘after shocks’ and negated the possibility of a major earthquake in the region. This argument was challenged in the scientific public sphere by employing three different strategies. The first involved a direct attack on the capabilities of scientists in Kerala. The ‘Letters to the Editor’ column in newspapers turned out to be a crucial site of criticism. A reader argued that the public did not trust the scientists’ denial of the possibility of any major earthquake in the region. He also suggested more research on the tectonic activities in the region in order to develop new techniques that help predict earthquakes. In a letter that appeared in Mathrubhumi, the reader, who was a scientist himself commenced his career in the CESS, criticised the scientists in the CESS for their neglect of and incompetence in studying the tectonic structure of the region. According to the reader, the CESS possessed the basic modern scientific infrastructure to conduct effective research in the earth sciences but alleged that the scientists in the institute lacked research experience. He added that Kerala was located in a geographical region with several active lineaments due to the presence of the Western Ghats on one side and the Arabian Sea on the other. Consequently, Kerala was prone to earthquakes but the

107 Ibid.
109 Ibid.
110 The reader argued that there had been rigorous tectonic activity under mountains and hence the presence of the Western Ghats was important.
scientists at CESS never accorded serious attention to this factor. Similar letters appeared in other newspapers also. The Deshabhimani in a report pointed out that scientists at the CESS were capable of undertaking only a preliminary analysis and that was why there was great discrepancy in their explanations.

Secondly, newspapers began questioning the argument of the scientists that earthquakes cannot be predicted. The Mathrubhumi suggested that the foreshocks, development of cracks in the rocks, presence of certain minerals and radon gas in the ground water, colour change, sudden rise and fall in water levels, rise of temperature and so on in the wells could serve as indicators of earthquakes. The news report suggested that geomagnetic changes and peculiar behaviours of animals and birds that occur before an earthquake are well-known earthquake warnings. The Deshabhimani also described the successful earthquake prediction attempts of Chinese scientists who studied changes in animal and bird behaviour prior to earthquakes. Both reports emphasised the failure of scientists in many instances to take into consideration the warnings of local people regarding the micro changes in their area just before the earthquake. They also emphasised that it was the Chinese and the Japanese scientists who were making considerable advancements in the area of earthquake prediction. The Malayala Manorama presented the case of an Indian scientist, Dr. Mukheijee, who claimed that he had developed a technique to predict earthquakes accurately with the help of changing sunspot activity. Based on recent photographs of sunspots from NASA, he even predicted the possibility for more earthquakes in different parts of India.

The third strategy involved a conscious effort on the part of the press to report incidents of micro tremors in the state as well as earthquakes from all over the world. The newspapers passionately reported even very small episodes of vibrations and

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111 Ibid.
115 Ibid.
117 Dr. S. Mukherjee, Associate Professor, School of Environmental Sciences, Jawaharlal Nehru University.
119 Ibid.
related phenomena from every nook and corner of the state. They included comments from the scientists in newspaper reports. All the newspapers reported the earthquake which occurred in the Central America that claimed the lives of hundreds of people and warned of a possible earthquake in the region. This detailed reporting of tremors and earthquakes from all over the world gestured towards the neglect of tacit connection between earthquakes and tectonic activity.

While this was the general mood in the scientific public sphere, scientists generally adopted a strong posture in insisting that there was no chance for a major earthquake in the region. But the totally unexpected and massive earthquake of magnitude 6.9 on the Richter scale that killed more than 17,000 people in Gujarat on Friday 26 January 2001 further eroded the public trust in the earth scientists of Kerala.

3.2. Gujarat Earthquake

When the Gujarat earthquake occurred, the controversy concerning earthquake prediction attained new heights in the scientific public sphere. Although the Malayalam press covered the impact of the disaster widely, interestingly all newspapers linked the event to the ongoing debates on earthquakes in Kerala. For instance, the point of difference between the IMD and the American Geological Survey over the magnitude of the earthquake bore striking similarities with the controversy between the CESS and the KSEB and the style of reporting of the dispute was deeply influenced by the latter. Similarly, in its editorial, the Mathrubhumi discussed the possible connections of the disaster with the earthquakes that occurred in El Salvador and Japan just a few days ago. The editorial suggested that large reservoirs like the Sardar Sarovar and Tehri Gahrwal possibly induced quakes in Gujarat. The occurrence of low intensity tremors one month prior to the Gujarat earthquake was pointed out and the manner in which scientists ignored local tremors

120 See the large number of reports in the Malayalam newspapers between 09.01.2001 and 12.01.2001.
122 The same reporting strategy has been repeated on different occasions to create a greater news impact in the scientific public sphere. See chapter 5 for more discussion on this.
was criticised in the regional press. Many of the newspapers discussed earlier predictions about an impending earthquake in Gujarat. The recurrent instances of tremors in Kerala were alluded to be of a similar nature, hinting the possibility of an imminent disaster in the region. The *Mathrubhumi* quoted Dr. Harsh Gupta emphasising the possibility of a major earthquake in the region in the future, contrary to the argument of the CESS scientists that there was no causal linkage between the Gujarat earthquake and the micro tremors in Kerala. In his letters to the *Mathrubhumi* and the *Kerala Kaumudi*, a reader critiqued scientists for discarding the possibility of prediction and demanded more sincere and committed research from Indian scientists in this direction. In short, the newspapers were attempting to amplify the fear of the publics regarding the possibility of a major disaster in Kerala similar to the Gujarat earthquake.

The Gujarat earthquake provided the opportunity for discussing larger issues about the tectonic structure of the Indian peninsula in relation to the tremors in Kerala, and the scientific public sphere was again activated by multiple voices, and interestingly there were many voices from within the scientific community too. Based on their investigations on the Kerala earthquake of 7 January, a group of environmental scientists raised the bogey of deforestation as a possible cause for the increase in the number of earthquakes in the state. The ‘sun spot theory’ of Dr.

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Mukhejee acquired more public attention at this stage,\textsuperscript{131} but there were many scientists like Dr. Srivastava of the IMD who questioned the validity of the sun spot theory.\textsuperscript{132} Srivastava upheld the uniqueness of Earth Science by distancing it from non-sciences like the astrology and pointed out that earthquakes cannot be predicted.\textsuperscript{133} However, new voices kept on appearing in the scientific public sphere, proposing the possibility of earthquake prediction. Dr. B.S. Bhattacharya, another scientist from the IMD, suggested that an effective earthquake warning system could be developed based on the detection of heightened tectonic activity just before the earthquake\textsuperscript{134} though he criticised the scientists "who make tall claims about prediction in the media, but never take the pain to prove their claims before the scientific community".\textsuperscript{135}

The successful predictions of earthquakes in the past by scientists from other countries were quoted to challenge the argument that earthquakes cannot be forecasted. The \textit{Madhyamam} pointed out the successful scientific prediction of the Blue Mountain Lake earthquake in New York (1973) and the Haicheng earthquake in China (February 4, 1975), both of which contradicted the assertion of some scientists of the impossibility of predicting earthquakes.\textsuperscript{136} A reader explained how he witnessed an earthquake being forecasted with great precision in Japan while he was there.\textsuperscript{137} In response to this letter, another reader pointed out that Japan benefits from traditional wisdom concerning earthquake forecasts, and that by observing the behaviour of a species of fish called the "living seismograph", they could forecast tremors.\textsuperscript{138} Scientific studies were cited which suggested that changes in the behavioural patterns of rodents, reptiles, birds, and cattle could be used to anticipate earthquakes.\textsuperscript{139} The possibility of developing a reliable prediction mechanism based

\begin{quote}
\textsuperscript{131} The sun spot theory of Dr. Mukherjee has been widely acknowledged and appreciated when his prediction was validated in the case of the Gujarat earthquake. See Anish M. Ali, "Bhookampangal Undavunnathu", \textit{M}, 05.02.2001, p.4, editorial page article.
\textsuperscript{132} "Bhookampam Pravachikkanavilla: S.K. Srivastava", \textit{MM}, 29.01.2001, p.3.
\textsuperscript{133} Ibid.
\textsuperscript{135} Ibid.
\textsuperscript{136} "Bhookampa Pravachanam: Vidadgharkku Bhinnabhshiprayam", \textit{M}, 29.01.2001, p.5.
\textsuperscript{137} M.J. Mathew, "Pravachicha Bhoochalanam Nerittarinjappol", \textit{MM}, 31.01.2001, p. 8, letter to the editor.
\end{quote}
on the abnormal behaviour of these creatures was also discussed alongside the possibility for prediction based on the radon gas emission from the earth.

The claims of some self-trained ‘scientists’ were reported in the press. For instance, the Madhyamam reported the ‘electro-magnetic theory’ suggested by P.N. Nair who had been studying the emission of ‘electrons’ in the atmosphere from the earth’s core during periods of increased tectonic movements. A large number of interpretations and arguments surfaced at this juncture in the scientific public sphere, many of the claimants presented themselves as experts on earthquake prediction. The ‘Letter to the Editor’ columns became a significant place for these self-claimed scientists to articulate themselves. For instance, a reader emphasised the lunar influence on tectonic activity. He analysed the relationship between tremors in Kerala and the occurrence of full moon or new moon days for the last one decade and found that eighty percent of the tremors appeared around full moon or new moon days. Another reader proposed a causal relationship between experimental nuclear explosions and earthquakes. He propounded the idea that the shockwaves from underground nuclear explosions had a tremendous impact on the stability of the tectonic plates that eventually triggered earthquakes since the shockwaves reverberate long after the quake and then get concentrated on a particular point under the surface of the earth. It was the nuclear experiments of India and Pakistan which he claimed to be causative of recurrent tremors and earthquakes in the Indian peninsula.

Astrological predictions of earthquakes were also aired in the scientific public sphere, albeit to a smaller extent. According to one astrologer, the Gujarat earthquake occurred on the most inauspicious day of the year: on that day the heavenly bodies were in a configuration that had an immense impact on the earth. With reference to the news that one astrologer had been arrested in Gujarat for predicting a fresh
earthquake and later released when the prediction turned out to be true, a reader argued that this incident indicated the usefulness of astrology for earthquake prediction and insisted that more research be done on the subject.149

The fear among the publics that the tremors felt in Kerala prior to the Gujarat earthquake was indicative of much deeper changes in the geological structure and an increase in the seismic activity of the peninsular region triggered more debate in the scientific public sphere. But the causal linkage between the regional phenomena and the Gujarat earthquake was refuted by most of the scientists. In this context, the scientific public sphere turned to be more inclusive of diverse explanations that challenged the scientists’ claims. The deliberations eventually led to a loss of trust in the earth scientists and the erosion of authority of science.

3.3. Collapsing Wells and the Collapsing Trust in Scientists

The debate on the predictability of earthquakes, as we have seen, helped to shift the focus to the likelihood of the occurrence of a major earthquake in Kerala. Newspapers kept a vigil on every single geological phenomenon that occurred in the region. The Deshabhimani reported the observation of fumes emanating from the ground at Vakathanam, a place near Kottayam.150 The water level imbalances in wells as well as small-localised vibrations were widely reported in the regional press.151 Rumours of a likely earthquake circulated widely and created a panic in Southern Kerala, and the scientists kept on denying the likelihood of the same.152 However, the newspapers never failed to bring in voices which went against the spirit of the proclamations of the scientific community.153

151 See the large number of reports that appeared in the regional press between 28.01.2001 and 05.02.2001.
153 K.R. Gopalakrishnan, the deputy director of the research wing of the KSEB, opined that an earthquake of magnitude 5.7 could occur in Kerala at anytime thereby challenging Dr. Kusala
It was just when the debate concerning the threat of a possible earthquake in Kerala was doing the rounds in the scientific public sphere that well collapses began to be reported from various parts of the state, followed by the oscillation of water levels in wells. In spite of newspaper reports on imbalances in water levels in wells in various parts of the state following the Gujarat earthquake, scientists did not pay much attention to the phenomenon, and they had their own scientifically valid reasons for the same. When a similar phenomenon was noticed in Kalamassery, near Ernakulam, the scientists from the DMG visited the place, but the local public complained that the scientists trivialised the issue. The CESS scientists consoled the public by explaining the phenomenon as due to the ‘seismic seiches’, a harmless and common phenomenon usually occurring in the post-earthquake period and pointed out that it appeared in Kerala as a result of the Gujarat earthquake.

However, the frequency of the occurrence of localised tremors gradually increased and more unusual occurrences were witnessed such as the oscillation of water levels in wells and fissures along the walls of buildings. The regional press painstakingly continued reporting these incidents from all parts of the region. The newspapers neatly knitted incidents of earthquakes and volcanic eruptions from all over the world with the events of regional relevance and hence by amplifying the phenomena, they tried to challenge the scientists’ view of the local incidents as inconsequential.

Rajendran of the CESS, who held that the possibility of a major earthquake in the region was negligible. Gopalakrishnan offered scientific reasons in support of his argument and accorded it the imprimatur of scientificity by quoting Dr. Rastogi. He also alleged that the CESS failed to coordinate the seismological research in Kerala. See “Keralathil Bhoochalanam Sadhyathaya Tallikkalayanavilla”, M, 31.01.2001, p.7. The RIS argument also reappeared in the scientific public sphere in this context, and the pros and cons were deliberated. For instance see, A.K. Manoj, “Bhookampa Sadhyathakulum Munkaruthalukalam”, MB, 31.01.2001, p.4; K. N. Krishnakumar, “Bhookampam: Pravachanantheethamaya Prathibhasam”, D, 31.01.2001, p.4, editorial page article; “Bhoochalanam: Keralathinu Asanka Venda: GSI Director General”, MB, 31.01.2001, p.5; “Bhookampam: Gujarathumayulla Tharathamya Arthasoonyam”, MM, 31.01.2001, p.4.


157 See the extensive reporting from different parts of the state in the latter half of February 2001.

158 See the reports on earthquakes in Indonesia, China, Japan, Vietnam, Indonesia, Malaysia, El Salvador, Taiwan, Central Asia, USA and Canada, which appeared in the regional press in the same period. The eruption of the Merapi volcano (Java, Indonesia) was also reported.
The *Mathrubhumi* systematically intervened in the scientific public sphere, by committing themselves to a position at this chaotic moment. In its editorial on 15 February, the newspaper pointed out that the anxiety created by the phenomenon is justifiable since the ongoing low intensity tremors and water oscillation in wells indicated deeper geological activity in the region.\(^{159}\) The editorial problematised the argument that these were 'low intensity localised tremors' by showing that the phenomenon appeared all over the state, and that the recurrent tremors nonetheless of low intensity could weaken the geological makeup of the region and hence the phenomenon needed to be scientifically addressed.\(^{160}\) The newspaper also raised the question of RIS.\(^{161}\) In his response to the editorial, a reader highlighted the contradictions in the scientists' arguments, when he criticised the geologists for trivialising the tremors as mere 'aftershocks' of the Gujarat earthquake, whereas earth science had already proved the occurrence of 'foreshocks' as an indication of a looming earthquake.\(^{162}\) He also corroborated his argument by highlighting the incidence of water oscillation which began in the region even before the Gujarat quake.\(^{163}\) The newspaper went a step further when it launched a special essay-series written by Sasidharan Mankathil, a geologist-turned-journalist.\(^{164}\) The essay meticulously challenged many of the scientific explanations, and pointed out that the public had lost its trust in scientists.\(^{165}\) The author strongly propounded the activation of lineaments in the region as the reason for continuing tremors in the region.\(^{166}\) The *Mathrubhumi* also published several readers' letters which shared similar concerns.\(^{167}\)

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\(^{159}\) "Bhoogarbha Chalanangal Thudarunnathu Apathsoochana Thanne", *MB*, 15.02.2001, p.4, editorial.

\(^{160}\) Ibid.

\(^{161}\) Ibid.

\(^{162}\) Ibid. 

\(^{163}\) Ibid.

\(^{164}\) Sasidharan Mankathil had his postgraduate training in geology and he joined as a researcher in a research project in the CESS. Slowly he shifted to journalism and later joined the *Mathrubhumi*. As a journalist he specialises on environmental issues as well as landslides and related geological issues. The series with the title, “Keralam Kulungumpol” (‘When Kerala Shudders’), was published from 17.02.2001 to 23.02.2001, with six essays in the editorial page. The series discussed the history of earthquakes, the geological structure, RJS thesis, etc. It also pointed out the sorry state of geological research in the state and made suggestions for effective research, including the preparation of a microzonation map.


\(^{166}\) Ibid.

The controversy became active again after a few months when wells started collapsing in Kerala. A major fear that was raised in this context too was its linkage to the regional tremors as well as the Gujarat earthquake. From July onwards collapsing wells became a very common phenomenon in the region, and the newspapers reported such cases from all over the state. Several other unusual geological phenomena were reported along with the increasing number of well collapses. These included the appearance of cracks on the walls of buildings, ground fissures, leaf fall, tunnel/well formation, change of the colour of water as well as bubbling and boiling of water in wells, ponds and paddy fields and coloured rains.

The unleashing of such a large spectrum of unusual geological incidents in the region created new problems for the scientists, as the local public demanded scientists’ visit to localities where such incidents occurred in order to provide an expert opinion and dispel the anxieties of the residents. In several instances, the local public entered into heated arguments with the experts challenging the scientific explanations being offered.

The public criticism of the inactivity of the government and the lack of authentic scientific interpretation of the phenomena forced the government to intervene in the issue. A research team appointed by the state government studied fifty...
cases of well collapses reported from different parts of the state, and pointed out in their interim report that the phenomenon was not earthquake related. According to the research team, the phenomenon was precipitated by the extreme pressure being exerted on the walls of the wells due to the accumulation of ground water when summer rains as well as the torrential monsoon rains in June hit the region. According to their explanation, it was mainly the poor construction of the wells that had to be blamed. Contrary to this report, the preliminary inferences from an ongoing study carried out by a team of scientists from the Kerala State Groundwater Department (KSGD) suggested that tectonic vibrations in the earth’s crust after the Gujarat earthquake along with the groundwater pressure was causing well collapses. This new study which underscored the linkage between well collapses and earthquakes created much debate in the following days. The director of the DMG, Dr. Padmanabhan Nair strongly refuted the findings of the KSGD scientists. He also pointed out that some of the prominent scientists in their team were from the KSGD itself. The CESS director strongly denied any possible relationship between earthquakes and well collapses, stating that not a single tremor had been reported from the region when the well collapses occurred. He suggested the changes in the rainfall pattern, unscientific well construction and soil characteristics as causes of the phenomenon. Dr. Baba, the director of CESS, explained the water oscillation in wells as caused by ‘micro tremors’, but negated any relation of this phenomenon to

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173 The research team constituted under the directive of the then Chief Minister of Kerala (A.K. Antony) consisted of scientists from the CESS, the Kerala State Department of Groundwater, the Central Groundwater Board, the Mining and Geology Department, and the Geological Survey of India.


176 Ibid.

177 "Kinar Aprathyakshamakal Bhoomiyude Puramthodile Chalanam Moolamennu Padanam", MB, 07.07.2001, p.1. The study concentrated on the collapsed wells at Pavangadu, in Kozhikode district from where the maximum number of well collapses had been reported. The research team was led by the Senior Hydro Geologist of the department, Dr. K.V. Mohanan, and the other geologists in the team were Anto Francis, K.K. Sajeevan and K.M. Ashraf. The research team studied the six collapsed wells in Pavangadu situated within two square kilometres. See “Kinar Thazhchaykku Bhookampavumayi Bandham", D, 05.08.2001, p.7. The Deshabhimani has published a report that showed the contrast between the two scientific studies. See, “Kinar Thazhunnathu Bhookampam Moolamallennu Padana Report", D, 09.07.2001, p.7.


179 Ibid.


181 Ibid.
The director of the Seismology Division of the Bhabha Atomic Research Centre (BARC), Dr. G. Jayachandran Nair also denied any tacit connection between earthquakes and well collapses, suggesting well collapses were due to ‘instabilities’ encountered thirty meters below the earth’s surface.\(^{183}\)

Several questions were been raised in the scientific public sphere regarding the well collapses and related incidents at this stage. The recent sprouting up of a whole range of geophysical phenomena as indicative of massive changes in the geology of the region that might result in a huge disaster in the near future was cause for much anxiety. While discussing the final report of the expert team, the *Malayala Manorama* highlighted the vagueness of the scientists’ explanation regarding the nature and pervasiveness of the groundwater pressure that has been portrayed as causing well collapses.\(^{184}\) In its editorial on the same day, the newspaper drew attention to the linkage between the earthquakes and the well collapses, though a direct rejection of the scientific report was not attempted.\(^{185}\) The *Mathrubhumi* in its editorial reiterated its earlier argument that the tremors in the region were not a localised phenomenon while relating it to the well collapses occurring all over the state.\(^{186}\) It was argued that the recent phenomena indicated vital alterations in the geological structure of the region which made it vulnerable, and therefore demanded more in-depth scientific investigations.\(^{187}\) The *Deshabhimani* in a report criticised the scientists for the ambiguities and contradictions in their statements as well as the callousness of the state government.\(^{188}\) The newspaper report also highlighted the differences of opinion between different scientific agencies who participated in the research.\(^{189}\) The *Madhyamam* in its editorial brought attention to the fact that despite being hit by many heavy rainy seasons, well collapses had never been reported before.\(^{190}\) The editorial proposed that earthquakes in the region were the primary cause of the phenomenon and suggested the need for more research on the subject.\(^{191}\)

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\(^{182}\) Ibid.

\(^{183}\) "Kinar Thakarcha Bhoochalanathinte Prathikaranamalla", *MB*, 22.07.2001, p.5. Nonetheless, he acknowledged the sorry state of geological research in Kerala and emphasised the need for comprehensive research on the phenomena.


\(^{187}\) Ibid.


\(^{189}\) Ibid.


\(^{191}\) Ibid.
detailed study of the geological structure of Kerala was important, the editorial argued, for drawing up a better environmental as well as developmental policy for the state.\textsuperscript{192} Many readers also expressed similar concerns.\textsuperscript{193}

The debates in the scientific public sphere took a novel turn at this point, thanks to the intervention of and the competition between two newspapers.\textsuperscript{194} The Mathrubhumi organised its reports and editorials around the ‘lineament theory’, which had taken its own course in the scientific public sphere a few months ago, with the essay-series it published on the earthquakes in the region.\textsuperscript{195} On the 27\textsuperscript{th} of July, the newspaper published a report that brought into attention the argument of some scientists that the lineaments in the region were getting activated.\textsuperscript{196} The report also alerted the public to the fear among some scientists regarding the occurrence of strange geological phenomena as presaging a massive earthquake in the region in the near future. John Mathai, a scientist from the CESS, was quoted in the newspaper as suggesting that well collapses occurred in a particular direction running parallel to the coastal line.\textsuperscript{197} He pointed out the existence of several lineaments in the same direction, and argued that the activation of these lineaments was causing the well collapses.\textsuperscript{198} He interpreted the associated geological phenomena such as the water level oscillation in wells and the localised micro earthquakes from this viewpoint.\textsuperscript{199} The Mathrubhumi published an editorial the next day, substantiating the lineament theory.\textsuperscript{200} The final report of the study conducted by the KSGD scientists at Pavangadu was reported in the newspaper as further elaborating upon the lineament

\textsuperscript{192} Ibid.
\textsuperscript{193} See the letters to the editor that appeared in the month of July in the regional press.
\textsuperscript{194} The competition between the Malayala Manorama and the Mathrubhumi for attracting more readers and thereby attaining more advertisement revenue has been observed. See Jeffrey 2000. Reporting of exclusive stories is part of the competition between newspapers.
\textsuperscript{195} See the series of essays published under the title “Keralam Kulungumpol”, written by Sasidharan Mankathil from 17.02.2001 to 23.02.2001. It is the same journalist who played the crucial role here also.
\textsuperscript{197} Ibid.
\textsuperscript{198} Ibid.
\textsuperscript{199} Ibid. It is interesting to note that the same scientists has been quoted later by some newspapers as arguing that the phenomena would not cause any havoc, since it simply indicated the tectonic adjustments of the earth. See “Apoorva Prathibhasangalil Asanka Venda: Sastrajnjar”, D, 08.08.2001, p.8; “Prakrithi Prathibhasangalil Paribhranthi Vendennu Sastrajnjar”, M, 08.08.2001, p.5; “Kinar Idichilum Varna Mazhayum: Asanka Vendennu Vidagdhara”, MM, 09.08.2001, p.2.
The lineament theory of well collapses was appreciated in the scientific public sphere as a valid scientific argument following this study. The increasing support for the lineament theory created great anxiety among the public. The Malayala Manorama at this stage went a step ahead, appointing its own team of scientists to undertake fresh research on well collapses. The team consisted of two reputed scientists from outside the state of Kerala. These experts spent three days in Kerala studying the phenomenon and consulting other scientists and explained that well collapses in the region was the net result of geological and geo-hydrological processes. The well collapses were conceived by them as a process in continuation with the earthquakes that struck the region in the months of December and January. The increase in 'pore pressure' as well as the changes in the 'stress field' due to the pressure that had accumulated in the bedrocks after the

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202 See the wide range of reports and articles in the regional press presenting the lineament theory as a strong argument against the expert opinion of the research team constituted under the directive of the Chief Minister of Kerala. However, this development did not prevent new scientific propositions regarding the phenomenon. For instance, the Deshabhimani published an article in which the authors suggested the tectonic activities in the ‘Ring of Fire’ region of the Arabian-Indo-Australian Plate as causing instability in the ‘continental shelf’. The vibrations from this zone, according to them, were responsible for the water oscillations and the well collapses in Kerala, a region which was already vulnerable due to continuing earthquakes and the presence of active lineaments. See S. Suresh Kumar and Dr. A.M. Nair, “Kinarukalum Kulangalum Enthukondu Aprathyakshakumunu?” D, 01.08.2001, p.4, editorial page article. The same scientists, in a letter to the editor in another newspaper explained the red rain phenomenon in terms of the Ring of Fire theory. See the next chapter. N.J.K. Nair, former director of the resource analysis wing of the CESS, propounded a hypothesis regarding the weakening of aquifers, a kind of rock that stored ground water. Because of deforestation, he argued, the aquifers failed to get refilled, and eventually became weakened. The well collapse as well as the water oscillation was explained as a trivial, harmless and localised phenomenon on the basis of this hypothesis. See Sajan Maranadu, “Kinarukal Kanathavunnathu”, Varadya Madhyamam, 16.09.2001, p.3.

203 The CESS Director however kept on opposing the lineament theory and reinstated the ground water pressure theory. See “Kinar Kanathavunnathu Bhookampa Soochanayalla: CESS director”, MM, 05.08.2001, p.9.


205 They were Dr. Janardhan G. Negi, Emeritus Scientist from the NGRI, Hyderabad and Arun Bapat, a Seismologist. Dr. Arun Bapat was formerly the Chief Research Officer of the Earthquake Engineering Research Division of the Central Water and Power Research Station at Pune.

206 The Malayala Manorama reported the investigations and other activities of the expert team on daily basis. The research team also visited the Chief Minister A.K. Antony. See the reports in Malayala Manorama from 12 to 17, August 2001.


208 Ibid.
earthquakes, they argued, led to changes in the course of ground water streams.\textsuperscript{209} When the rain stopped, there was a sudden decrease in the amount of groundwater and the vacuum created under the well due to these complex processes, in their opinion, caused the well collapse. They also noted that the collapsed wells were situated at the nodal points where the lineaments met. They referred to the KSGD study as substantiating their argument.\textsuperscript{210} The new argument blended both the groundwater-pressure theory and the lineament theory within its fold, and the status of them as two mutually contesting and incommensurable hypothesis had been defused by the intervention of the expert team from outside Kerala. More detailed investigations on the lineaments as well as the tectonic structure of the region were suggested by them.\textsuperscript{211} In its editorial response to the findings of the research team, the \textit{Malayala Manorama} demanded more research on the subject.\textsuperscript{212}

However, other newspapers simply ignored such an initiative of a rival newspaper. The \textit{Mathrubhumi} continued pushing with the lineament theory, laying more emphasis on the necessity of a comprehensive study about lineaments in the region.\textsuperscript{213} The newspaper reiterated the possibility of an impending earthquake in the region and pointed out that the scientists who proposed the lineament theory could not do further research due to the lack of infrastructure. Taking into cognisance the limitations of regional research system, the \textit{Mathrubhumi} urged the state government to request national scientific institutions, which have better facilities and expertise, to conduct further research in the region.\textsuperscript{214}

Of course, there was no permanent closure of the controversy, nor did the unusual geophysical phenomena cease to occur. Similar events still continue intermittently in the region and so do the debates.\textsuperscript{215}

\begin{itemize}
\item \textsuperscript{209} Ibid.
\item \textsuperscript{210} Ibid.
\item \textsuperscript{211} Ibid.
\item \textsuperscript{212} "Kinar Thazhunnathinepati Kooduthal Padanam Venam", \textit{MM}, 21.08.2001, p.9, editorial.
\item \textsuperscript{213} "Kinarukal Idiyunnathu Bhraman Meghalakal Kendreekarich", \textit{MB}, 23.08.2001, p.1.
\item \textsuperscript{214} "Sastrajna Sanghathe Niyogikkanam", \textit{MB}, 24.08.2001, p.4, editorial.
\end{itemize}
4. Conclusion

In this chapter, we have discussed the unravelling of a series of interconnected scientific controversies in the scientific public sphere triggered off by a series of tremors that rocked the region. The case study looked at the process of negotiation while scientists grappled with the unusual geological phenomena which appeared in the region. The appearance of the phenomena resulted in the emergence of an active scientific public sphere constituted by the regional press. The public deliberation on the controversy suggests that the scientific public sphere was a deliberative space where different actors with different kinds of expertise participated, engaging with science. In the course of negotiation, the tacit processes involved in scientific knowledge production came under full public view.

When the scientific public sphere is constituted in the context of a scientific controversy, the scientists and the scientific institutions come under rigorous public scrutiny. The scientific public sphere also turned out to be one of the sites where rival networks of scientists come into open conflict, and the polyphony of science is revealed. These networks and associations were originally constituted on disciplinary and institutional lines. For instance, the rivalry between the CESS and the KSEB research wing was crucial in the course of deliberations on the case. At each level of the case, closure was attained when there was a consensus achieved over the evolving interests of the actors.

The case also showcased the relationship between science and media. It can be seen that there was a symbiotic relationship functional between the scientists and the newspapers. The newspapers seriously participated in the debate by patronising certain scientists and institutions. The Malayala Manorama even commissioned new research on the phenomena by appointing their own research team. Since Kerala has a highly politicised reader public, the scientists could not avoid being accountable for their research to the public. Under the pressure of maintaining their readership, the newspapers also contributed to this process of public scrutiny by staging the deliberations in the scientific public sphere. In this process, the role of the newspapers as stage managers was crucial as they created a space for polemic. The strangeness of

\[^{216}\text{The 'natural phenomenon' itself is in fact carefully constructed through a complex discursive process. This process of constructing the event is highly influenced by two powerful entities of the modern world, science and media.}

\[^{217}\text{See chapter 4.}\]
the phenomena as well as their direct impact on the daily lives of the people facilitated the process of deliberation in the scientific public sphere and thereby accentuated the public accountability of science. Wynne's study of the engagement of Cumbrian hill sheep farmers with scientists (Wynne 1996) indicated that scientists were often reluctant to pay heed to non-scientist actors, and it led to the deterioration of public trust in scientists and the delegitimisation of scientific explanations provided by them. This process contributed heavily to the loss of authority of scientific institutions in the state. At the same time the course of negotiation revealed how the phenomena was scientifically explained and managed through a complex process in which the deliberations in the scientific public sphere played a crucial role. The coloured rain controversy, which was a sequel to the controversy studied here, further reveals the dynamics of this process of public deliberation. The next chapter will discuss this strange phenomenon and the deliberations that followed in the scientific public sphere.