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Heritage threatened by earthquakes and floods in New Spain and its interpretations

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Abstract: This paper seeks to identify and understand the different interpretations regarding earthquakes and floods in New Spain. In those years, cultural heritage assets such as buildings were not considered "heritage"; nonetheless, New Spain's constructions were at risk due to natural phenomena. Although the providential interpretation (religious explanation) of these phenomena was the most prominent, there existed some debates between scientists and representatives of the Church. Information regarding the ideas related to earthquakes was gathered through different viceregal sources from the 16th and 17th centuries, particularly from the statements of three spaniards that lived in New Spain: Tomás López Medel, José de Acosta y Juan Cárdenas. Inhabitants of New Spain's interest in disasters manifested, at the time, by mentioning the damage to temples and convents, and in extreme cases, to nobles' houses. It is never mentioned whether there were indigenous victims or homes damaged. The concept of victim did not exist. In the 18th century, José Antonio Alzate y Ramírez provided an interpretation of earthquakes based on the caves of Lucrecio and the enclosed air of Seneca. The great flood of 1629-1634 in Mexico City, was the turning point that marked the 17th century in terms of social, religious and scientific interpretations and debates.

Key words: Colonia; disaster; earthquakes; floods; processions

1 Introduction

Broadly speaking, this study aims to write a history of scientific and religious beliefs about disasters in New Spain. The long-term perspective is interesting because it identifies continuities and breaks in thinking about disasters and fears; thus, this study covers the various centuries known as the colonial era in New Spain.

In New Spain, ideas regarding catastrophes were shaped by two types of discourse: that of the Church, whose interpretations were rooted in Christian dogma originating primarily in Europe; and the early discourses of "scientists," who sought to rationalize these phenomena but whose ideas originated in ancient thinkers, such as Aristotle, Seneca, and Lucretius.

Natural phenomena were not yet understood by the clergy and intellectuals of New Spain. The natural world was viewed as threatening, powerful, and uncontrollable; for these reasons, it instilled fear in both the common people and the New Spanish elites, who had accumulated wealth.

When an earthquake occurred, the elites would submit a series of petitions to the King requesting tax relief; these

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were generally granted. Disasters also presented an opportunity for the colonial elites to enrich themselves. In some cases, certain disasters also made it possible to suppress indigenous uprisings. The focus of this article is to examine how New Spain society constructed a discourse on disasters throughout the colonial period, and how a paradigm shift occurred as scientific explanations became established. It thus demonstrates that various discourses can coexist within the same era, supported by different dominant groups in society, such as the Church and the rulers themselves. Fear of seismic or climatic phenomena compelled the people of New Spain to design earthquake-resistant building systems and to use appropriate materials, such as (volcanic) stones in the masonry of houses and public buildings. This did not prevent New Spanish society from resorting to certain Christian rituals in the face of phenomena it did not understand.

2 Method

This historical study was developed based on a reflection on the ideas and beliefs of the people of corpus of sources spanning the 16th through the 18th centuries. The method employed for this purpose is a compilation of historical sources ─ some primary, others secondary ─ that allow for a comparison of the various divergent discourses (scientific, religious) of the New Spain elites. As Rogelio Altez (2002) proposes: "This involves a methodological understanding of how reality was interpreted in the contexts of past disasters; that is, adopting a perspective on data analysis that differs from a quantitative one, and understanding what those phenomena meant at the time." The aim is thus to identify the discourse within each context in order to understand the documents and actions of the elites of New Spain.

It is important to clarify that research on past disasters cannot be applied in the same way we do today: the goal is to understand the ideas and thoughts contextualized within that specific era, within a particular social context (the colonial period). The framework of thought that structured Western culture and its colonial extensions was grounded in faith and did not seek to know or understand phenomena. The Bible and the Church's evangelizing discourse were the primary sources of knowledge; however, in the 18th century, positivist discourse emerged, along with a process of describing, classifying, and analyzing phenomena with the aim of understanding reality. This did not happen overnight but was the result of "a process of profound transformations in the interpretation of societal reality, driven by concrete changes among decision-making classes" (Altez, 2002). Of course, this study adopts both a diachronic and a synchronic perspective: we had to consider the colonial era within its cultural context and during well-defined time periods. We examined the historical and political contexts that shaped shifts in the perception of events and their interpretations. Within these periods (16th–18th centuries), we analyzed distinct phenomena and ways of thinking from a synchronic perspective. Thus, it is interesting to explore the responses, interpretations, and perceptions of these phenomena, as well as their impacts on societies and cultural heritage.

3 Science and society in New Spain

During the three centuries of colonization in New Spain, scientific development was hindered by beliefs, superstitions, censorship, and the Church's control over education. While this is generally true, we must qualify this period of history, which was typically written by Creoles or Spaniards who held some power. We must not forget that for Spain, most of the 17th century was a period of decline: the persecution of Jews and converts caused Spain to lose a considerable number of intellectuals and scientists, and consequently, its colonies were indirectly affected by this loss.

Colonial commercial and scientific activities were controlled by organizations that brought together those engaged in them, but they were subject to the rule of the viceroy or the Church. By this we mean the ranchers, merchants, the university, and the miners (the Mining Seminary). These were not independent organizations, and they could not enjoy freedom of expression, a term we use today. The Church had the power to control consciences and culture through two instruments: education and the inquisition. The latter, created toward the end of the 16th century, was established to punish

those who opposed the Church's authority. Despite the indigenous peoples' conversion to Christianity, it was common for indigenous communities, while contributing to the construction of new churches, to hide behind or beneath the altars—or even within the masonry walls—figures of the traditional gods whom they venerated just as they did the Catholic saints (see Figure 1).



Figure 1. Pre-Hispanic glyph incorporated into the church of Santiago Tilantongo, Oaxaca, 2013; source: author's archive

Among the Creoles and the Spanish colonizers, there was a mix of different worldviews: various conservative tendencies that promoted common ideas from the Middle Ages, as well as ancient conceptions regarding earthquakes and other disasters; others promoted Renaissance ideas that pointed toward a certain freedom of thought. At the end of the 16th century, Philip II signed the decree establishing the University of Mexico with the aim of "founding a university of all sciences, where the natives and the children of Spaniards might be instructed in the matters of the Holy Catholic Faith and in the other faculties." This founding clearly indicates that science (the faculties) was not separate from the Catholic faith (L.E. Todd et al., 2009).

At the end of the 16th century, some scholars, such as the Jesuit priest Joseph De Acosta, attempted to revive ancient theories regarding earthquakes, such as those of Aristotle (*Meteorologica*) and Seneca (*Natural Questions*), authors who posited that earthquakes are caused by pressurized air circulating beneath the Earth's crust and seeking an outlet to the surface. These ideas prompted a surprising reaction from the authorities in Guatemala City when an earthquake struck in 1651, as they asked residents to dig holes in their gardens so that the air could escape. Father De Acosta explained, in his treatise (*Natural and Moral History of the Indies, 1591*), why the ground in New Spain was particularly prone to earthquakes:

> Throughout this Indian land, the conditions and causes necessary for the earth to tremble frequently are found. First, there is more than enough heat from the sun, which, with the directness and force of its rays, penetrates to the very depths of this Indian land, raising the aforementioned vapors and exhalations—which are what cause the earth to tremble; there is also sufficient material cause for these vapors to rise, because the center of this western land is cavernous and full of water; from this very water, under the heat and force of the sun, infinite vapors evaporate and swirl, which, as they grow, become constricted and compressed within the caverns themselves until they burst forth and escape through some opening (cited by Musset, 1996, p. 33).

Thus, in the 17th century, scholars continued to follow 16th-century treatises—such as that of Father De Acosta—which did nothing more than repeat the ideas of antiquity. These theories made it possible, as Musset (1996) emphasizes, "to explain why the city of Panama did not suffer from earthquakes, unlike other cities in Central America." Indeed, according to Juan Requejo Salcedo, who wrote his *Historical and Geographical Account of the Province of Panama* in 1640, sandy soils limit the effects of earthquakes, since, by their very nature, they dissipate the exhalations and atmospheric vapors considered responsible for movements in the Earth's crust." In fact, when the 1621 earthquake struck, Panamanians were taken by surprise by the violence of the quake, which destroyed their wooden houses. Musset (1996) notes that:

> Until the end of the colonial period, these theories prevailed among the pseudo-scholars and literati—often religious figures—who made up the intellectual elite of an urban world that lagged far behind the discoveries made since the heroic days of the Renaissance; in the mid-18th century, the Gaceta de México was still explaining to its readers that the Earth was at the center of the world and that Aristotle's primum mobile animated the various celestial spheres (Musset, p. 34).

The first scientific journal published in Mexico City, in 1768, was the *Diario literario de México* by José Antonio Alzate y Ramírez (1737–1799). Alzate's scientific works and their dissemination had a major impact in the Americas and Europe; in fact, he was a corresponding member of the Paris Academy of Sciences. Issue No. 6 of the Diario discusses an earthquake felt in Mexico City, as well as various types of seismic activity. The earthquake of April 4, 1768, is mentioned as follows in the Diario:

> When, in the month of April 1768, a great tremor was felt […] in the vicinity of Nativitas, Ixtacala, a town near the shrine of Our Lady of Piedad, the earth split open, and from the fissure—which was barely a third of a vara wide but very deep, as was observed—a strong wind emerged: Where did it come from? What was its origin? (quoted by García Acosta and Suárez Reynoso, 1996:135).

This comment reveals the persistence of the ideas of the ancient philosophers, namely, the breath emanating from the depths of the earth as the cause of earthquakes.

The spread of modern scientific theories had notable precedents in New Spain during the 17th century, particularly in the fields of physics, astronomy, and mathematics; however, their assimilation gained momentum later, in the 18th century. Although ideas for understanding catastrophic phenomena were still rooted in past centuries, there were some trends toward integrating these new ideas into the American context. Scientific ideas began to take on certain characteristics in the colony, such as pragmatism and localism (in relation to the climate), particularly regarding agricultural practices and the alternating cycles of droughts and rains.

Thus, the momentum of the sciences in the 17th century continued into the following century until it challenged the power of the Church. The Church, in response, had many strings to its bow—that is, it possessed a powerful ideological apparatus and potent tools to blame and punish the people in the face of natural threats and disasters.

4 Earthquakes and their interpretation in New Spain

During the colonial period, rational thought and theology intertwined in the explanation of natural phenomena. Scientific interpretations at that time were steeped in religious aspects, worldviews, and theories about earthquakes (which invoked divine manifestation). Based on the principle that God created the world and nature, every natural phenomenon was consequently seen as a product of God. During the colonial era, there was no real conflict between ancient thought and the Church, except when destructive phenomena such as earthquakes occurred, which were considered manifestations of divine wrath (since adherence to church dogma was required).

The Church, without truly realizing it, helped establish a way to gauge the duration of earthquakes. For example, in the 17th and 18th centuries, the duration of earthquakes was measured in terms of prayers: creeds and psalms; it was said, for instance, that an earthquake lasted three prayers or four psalms. Terrified people would begin to pray, and in this way, the duration of the tremor could be measured. In Oaxaca in 1682, an earthquake occurred on St. Joseph's Day:

> It shook horribly; it lasted about six creeds; it was at three in the afternoon. These are the famous earthquakes of Saint Joseph that caused great damage in Oaxaca, which is why they made him their patron saint (Antonio de Robles, cited by García Acosta, 2001:53).

Here, the time of the event is mentioned; however, such a record could only be made beginning in the 17th century, particularly from the year 1665 onward (C. Huygens), through pocket watches fitted with spiral springs.

The intensity of the earthquakes was assessed using terms such as "strong," "large," "enormous," or "catastrophic," without any real understanding of their actual intensity. In the 16th century, only damage to churches and convents was mentioned, and in extreme cases, to the homes of nobles. Indigenous dwellings were mostly made of adobe or wattle-and-daub and suffered damage to a lesser extent; however, in Oaxaca, some stone houses, due to their proximity to the epicenter, were damaged. It was rare for deaths or injuries to be mentioned; the concept of a "victim" did not yet exist. In the 17th century, written sources, such as documents issued by the viceroy or ecclesiastical authorities, did mention damage to walls caused by the forces of seismic movements. These descriptions also served to request from the King of Spain a reduction in certain taxes, such as the sisa and the wine tax, or the "two novenos reales," as mentioned by García Acosta (2001). It was also important to request funds for the reconstruction of churches or convents. To this end, rational thinking began to emerge; it was no longer a matter of asking God for mercy, but rather of requesting funds from the royal authorities.

Knowledge during the colonial era could not recognize the existence of epicenters, it was only accepted that an earthquake could affect several places at the same time, acknowledging the existence of a single phenomenon. Earthquake historians have not found in the scientific texts of the period, up until the end of the 18th century, any particular interest in identifying the source of seismic waves.

Among scientific sources, García Acosta (2001) mentions three Spaniards: Tomás López Medel, José de Acosta, and Juan de Cárdenas, who were in New Spain in the 16th century and addressed the topic of earthquakes in light of the knowledge of the time. López Medel (1520–1582) wrote his work (*Relaciones geográficas*) around 1570, based on the three elements that constituted the world in his cosmogony: air, water, and earth. In the chapter on air, López Medel associates hurricanes with earthquakes and highlights the Aristotelian theory of subterranean winds. He attempts a classification of earthquakes, describing those that occur in coastal areas, that is, along the shores—as unique, based on the idea that these areas are more porous and cavernous than the mainland; and he observes that "they occur regularly every year at the beginning and end of the rainy season." Finally, he concludes that "earthquakes throughout the country are precursors to rains and floods and ‘heralds' [sic] of them." The Jesuit José de Acosta (1540–1600) lived in Peru for 14 years and spent less than a year in Mexico City. His work, *Natural and Moral History of the Indies* (1590), draws on the ideas of the classical authors Aristotle, Seneca, and Pliny, and addresses the three elements, just as his predecessor did. He acknowledges that earthquakes are not always related to volcanoes because they occur in non-volcanic areas. But he locates the origin of earthquakes in underground caverns. He establishes a correlation between water and increased seismic activity; and he explains the earthquakes in Mexico City by the existence of the lagoon.

The third author cited here, a 16th-century Spaniard, Juan de Cárdenas (1563–1609), was a physician from Seville who arrived in Mexico at a very young age and who based his explanations of the origin of earthquakes on the presence of

internal cavities in his work titled *First Part of the Problems and Marvelous Secrets of the Indies* (1591). He began to pose questions such as: Why do earthquakes occur so frequently in the Indies, more than 100 times a year? He opposes the theory that associates earthquakes with winds trapped in the earth's caverns. He also refers to Aristotle and his *Meteorology*, and shares the ancient view that vapors trapped in the earth's caverns, generated by the sun's heat, cause the water inside to move in search of an outlet, shaking the earth and inducing tremors.

García Acosta (2001) observes, through sources from the 16th and 17th centuries, two types of interpretations regarding the origin of earthquakes: a) a direct relationship between seismic activity and volcanism; and b) the association of earthquakes with the presence of meteorological phenomena such as comets and eclipses, rain, hurricanes, or snowfall. None of these explanations questions the divine origin of the phenomena. For example, José de Acosta links the earthquakes in Mexico City to lakes.

It is interesting to observe this so-called "scientific" view, held by a few scholars, alongside the popular and providentialist beliefs of the same era. The Church did not deny these phenomena, but saw in them a divine origin resulting from God's punishment. There is no evidence of a controversy between the defenders of "rational" knowledge and the Christian view regarding earthquakes. This is for a simple reason: scholars were shrewd enough not to confront the power of the Church. At that time, the Christian view was widespread in Europe and the Americas before the Enlightenment. Some clergymen knew how to present their ideas without publicly questioning that God was the creator of all things. We can only mention one debate among scientists in the 18th century between Neptunists and Plutonists, regarding whether volcanic activity had a maritime origin or stemmed from the depths of the earth (Musset, 2011).

In the 18th century, scientists continued to associate earthquakes with other phenomena. However, in the second half of the 18th century, there was more scientific research. In the first half of the century, the same interpretations were still prevalent. Regarding the earthquake of May 16, 1729, the chronicler Juan Francisco Sahagún de Arévalo, drawing on Aristotle's theory of the four elements, argued that the natural causes of earthquakes were attributable to the force of the sun's rays, which generated exhalations within the Earth's body that sought an outlet and caused terrestrial movements (García Acosta, 2001).

There are various interpretations of the earthquake of April 4, 1768. On the one hand, Joaquín Velázquez de León (1732–1786) describes the earthquake but offers no opinion on its causes: he was merely a self-taught astronomer. José Antonio Alzate y Ramírez does offer an interpretation of the same earthquake, drawing in his analysis on Lucretius's caverns, Seneca's trapped air, and Buffon's internal combustion, and he believes in "the existence of an internal fire that causes the heating, fermentation, and ignition of subterranean materials" (García Acosta, 2001:102). He goes so far as to distinguish two types of tremors: the first related to the need for air to escape, and the second caused by the ignition and explosion of matter. The second type is again conflated with volcanism. He may have been the first to take an interest in the seismic resistance of buildings; his reasoning led him to propose some ideas on how to build in seismic zones (which, in fact, were not well defined at that time); he spoke of the dangers of building on piles, citing the example of the 1783 Messina earthquake in Sicily (Italy), where buildings constructed on piles were completely destroyed. Of course, he did not know that Venice was built on wooden piles, just like Messina—since both are cities on the water—and that this was not the cause of the collapses. But what is interesting here is his concern with how to build in seismic zones (which is admirable for the time). The city of Messina, incidentally, was almost completely destroyed by the 1908 earthquake.

Unlike local scientists such as Alzate, the many and varied religious practices were not intended to help people understand the phenomenon, but rather to appease the divine wrath that causes earthquakes. These religious practices were either collective or individual in nature. They were carried out after the earthquakes, either by the Church or by the people

themselves. Collective practices included processions, masses, and rogations (public prayers). All were organized around the identification of saints — particularly Marian devotions — as patrons against earthquakes, as we have seen above. Prayers were directed through the intercession of the saints: Saint Joseph, who was recognized as the "advocate against earthquakes" in several cities; Saint Philip of Jesus (in Colima); Saint Nicholas of Tolentino; and the Virgin Mary, such as the Virgin of Guadalupe, the Virgin of Solitude, the Virgin of Los Remedios (Figure 2), and the Virgin of the Holy Cross. Since these prayers were addressed to the saints, a custom arose in New Spain of naming earthquakes after saints. Thus, we have the earthquake of San Silvestre (December 31, 1603); or the earthquake of San José (March 19, 1682). Alongside the processions to pray for the safety of the inhabitants, Musset (2011:94) notes that "the Franciscans, Dominicans, Jesuits, Brothers of Mercy, and Brothers of St. John of God competed in acts of torture, suffering, and prayer to better move the Lord to mercy; some subjected themselves to self-flagellation, with a rope around their necks, sackcloth and a hair shirt on their shoulders, their limbs weighed down by chains and shackles, and their tongues clamped with iron tongs — and thus they wandered through the city streets."

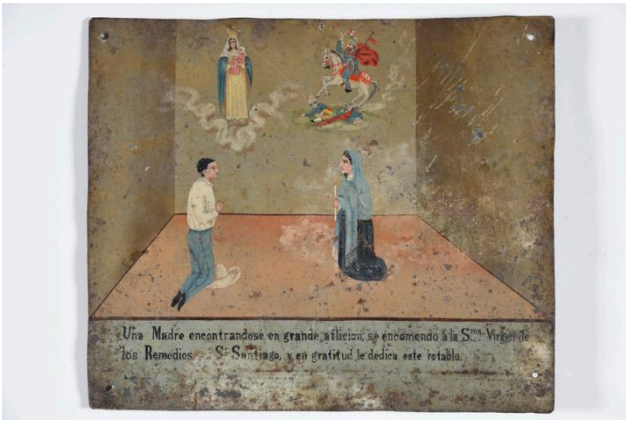


Figure 2. Ex-voto to the Virgin of Los Remedios. Source: INAH Media Library, Museo del Carmen Collection.

This also explains the importance of religious images of the saints, beginning with depictions on paper based on wood or metal engravings, and later—following the introduction of lithography in the 19th century—printed images on paper, such as the popular works of Guadalupe Posada (Figure 3). Even today, it is very common to find, on family altars, images of the saints who protect against earthquakes. It is also worth mentioning the ex-votos painted on metal sheets, offered to thank the Lord for having saved a family member from the collapse of a house caused by an earthquake.

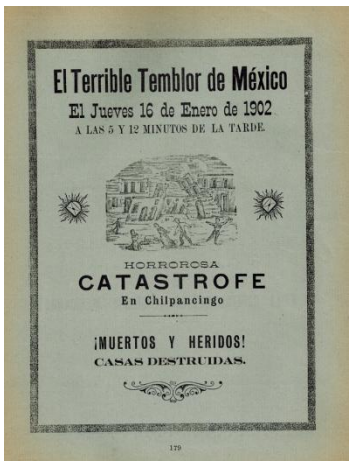


Figure 3. Guadalupe Posada, Flyer, 1902; source: Frances Toor, Mexican Folkways, No. 3, Vol. 4, 1928

These religious expressions also served as a way to gauge the intensity of earthquakes, both by the opulence and size of the processions and by the length of the route traced through the city's streets and the number of processions. As an example, the earthquakes in April 1776—cited by García Acosta (2001)—in Guerrero, Oaxaca, and Mexico City, which led to 16 processions over the course of three weeks. Perhaps the most original anti-seismic measure was the one taken in Lima in 1687, following an earthquake, at the initiative of the viceroy: ordering women to lengthen their skirts, because they had offended the Lord by exposing their calves to men (Musset, 2011:90).

After the earthquakes, beginning in the 18th century, authorities began compiling records of the damage, particularly to monuments and churches. Likewise, funds were established for reconstruction through alms, the use of income from Church properties, and funds from religious brotherhoods. These funds, however, were directed toward the reconstruction of churches, not homes. There were occasions when civil authorities raised funds to aid the victims, but this was not the norm in the colony. The concept of a "victim" had yet to be invented...

5 Colonial floods

The great flood of 1629–1634 in Mexico City shaped the 17th century in terms of social, religious, and scientific interpretations and debates; it occurred somewhat like the Lisbon earthquake, which was a watershed moment in ideas about disasters in the XVIII. The catastrophe caused by this flood lasted five years and marked a period of debate among scientists, officials, engineers, and friars, including some Creole perspectives critical of the Spaniards, who were held responsible for the disaster. By 1608, the Nochistongo drainage canal—a product of Spanish engineering and indigenous labor—had been completed, but it was of no use because it collapsed.

The hydrologist Enrico Martínez (1550–1632) explained the phenomenon in terms of the ecological changes brought about by Spanish livestock farming, deforestation, intensive grazing, and the expansion of crops, as these had eroded the topsoil; thus, year after year, the rains washed this soil into the lakes, raising the water level and causing floods during heavy rains, such as in 1604, 1607, 1615, 1623, 1627, and 1629 (Everett Boyer, 1975). In this regard, the city's vulnerability to flooding is perfectly understandable when considering the 17th-century map of Mexico City, which shows it surrounded by chinampas and protected only by the albarradón (see Figure 4).



Figure 4. Map of Mexico City in the 17th century (source: Alfredo Becerril Colín, 1961)

The viceroy and the city council reviewed the costly drainage projects that had failed, and there was talk of returning

to the pre-Hispanic system of dikes and dams. There was also talk of abandoning the island and relocating the city to higher ground, as Philip II had proposed.

What the Spaniards, and foremost among them, Cortés, had not considered was that the construction of large buildings for the new city required an impressive number of wooden piles and beams. This wood came from the hills, and thus deforestation began with the construction projects of the first conquistadors. To give us an idea of this, building Cortés's house required 7,000 cedar beams, which were transported from the hills by 1,200 indigenous people (Everett Boyer, 1975). Thus, the city built on the site of ancient Tenochtitlán became extremely vulnerable.

Despite warnings from some (such as Viceroy Luis de Velasco, who informed Philip II that an unsafe site had been chosen instead of a harder, safer piece of land just a few leagues away), as early as 1584 Father Ponce warned that filling in the canals was not suitable for monumental architecture, and that the convents of Santo Domingo and San Agustín were indeed sinking. Thus, during the 300 years of colonial rule, the Spaniards who had destroyed much of the work carried out by the Mexicas, had to suffer the effects of the floods. In 1629, Enrico Martínez made the disastrous decision to block the entrance to the drainage canal for fear that the waters would destroy it; as a result, the waters overflowed the levees and dams, flooding the lower parts of the city.

Alongside these rational analyses of the causes of the floods—which the traveler Humboldt revisited in the early 19th century (1803), noting that the erosion caused by deforestation was disrupting the entire hydraulic system of the basin, there are also religious elements and beliefs rooted in the Bible. Thus, the Franciscan friar Juan de Torquemada (1557 – 1624) proposed a religious explanation for the floods, even though he had not lived through the flood of 1629. For him, the lakes of Mexico City were a reminder of the biblical Flood, and the indigenous people had been condemned to live in the water because of their sins (Cuéllar Meléndez, 2017). Thus, divine punishment was the cause of the floods. History does not say whether the indigenous people sinned more than the Spaniards, but it is estimated that some 30,000 indigenous people died in the 1620 flood, as well as several prominent Spaniards, such as the city's corregidor, the viceroy's daughter, and a professor of theology (Everett Boyer, 1975).

Torquemada's interpretation is not an isolated one; it reflects the thinking of many Christians of the time. There is also a curious idea described by several 16th-century chroniclers, who noted that with the arrival of the Spaniards, the lakes began to recede. Motolinia (1482–1569) mentions this as a witness account and interprets it as a manifestation of the postponement of divine wrath due to the Spanish conquest of the indigenous peoples, who were considered bloodthirsty (Cuéllar Meléndez, 2017). Motolinia regarded the lakes as a remnant of the Divine Flood, since the human sacrifices described by Bernardino de Sahagún had not disappeared among the indigenous peoples (although this might have diminished with the suppression of such sacrifices). This relationship between lakes, sacrifices, and punishment is very interesting, as these are real elements that highlight the construction of an imaginary discourse based on ancient rhetoric that encompassed a particular concept: the impossibilia — which consists of presenting contradictory elements or impossible images, such as lakes/sacrifices or lakes/punishment.

Motolinia, reflecting on the Flood in the Valley of Mexico, was astonished by the height of the mountains surrounding that valley and wondered how these mountains could have been submerged during the universal biblical flood. Furthermore, for him, Popocatépetl is not Mount Ararat, and the volcano's fumaroles ceased in 1528, which constituted a divine sign of the justified conquest.

What also made the floods incomprehensible was the fact that while the lakes were shrinking, the floods became more frequent and more disastrous for the inhabitants throughout the colonial period. It was difficult for the Church to understand this contradiction (not to mention the conflicting proposals from the "experts" in hydrology, who tried—

without any real success—to put an end to the floods). Then, in the middle of the 17th century, there was a shift in thinking: the floods were no longer a divine punishment for the sins committed by the indigenous peoples; now divine punishment was attributed to the city's own inhabitants, due to their moral decay and decline, as Bishop Juan de Palafox y Mendoza (1600–1659) asserted.

But the Church had other means of combating the floods. The goal was to appease God's wrath, and the solution lay in seeking the intercession of the saints and the Virgin Mary. The city's first patron saint against floods was Saint Gregory Thaumaturgus, in the early 17th century, particularly during the years 1604–1607, when severe flooding occurred. The saint was one of the Church Fathers of the third century A.D. and bishop of Neocaesarea in Turkey; he was credited with several miracles related to water. Devotion to him peaked in the wake of the floods of 1629, but despite the procession organized around the Cathedral, the water level did not recede; devotion to him waned, and his cult began to fade in the second half of the 17th century, until it ceased entirely (Cuéllar Meléndez, 2017).

But there was another saint, the Virgin of Los Remedios, known as "she who heals all ills," who had been the city's patron saint since the 16th century. In the second half of the 17th century, the Virgin of Los Remedios enjoyed great popularity in Mexico City and its surrounding region, making her comparable to the Virgin of Guadalupe, whose cult had not yet taken hold. The sanctuary of the former, where the Basilica now stands in the municipality of Naucalpan, State of Mexico, practiced a form of worship with a strongly indigenous character and was closely linked to the City Council of Mexico City. The viceregal government allocated various resources to strengthen the worship of the Virgin and thereby exercise over the indigenous people of the surrounding towns.

In August 1629, as the waters continued to rise, the city council organized a novena at the chapel in Naucalpan, where it unveiled the image of the Virgin. Unfortunately, a few days later a downpour flooded the city. Later, like Saint Gregory, the Virgin lost her prominence and was replaced by the Virgin of Guadalupe as the city's patron saint. The Virgin of Los Remedios was, however, invoked in more than seventy processions between the 16th and 19th centuries.

Some chronicles mention that, during the flood between 1629 and 1630, a procession brought the image of Our Lady of Guadalupe to the cathedral. Others mention that the images of Our Lady of Guadalupe and Our Lady of Los Remedios remained in the city until the waters receded. It appears that we are dealing with the political construction of a devotion exploited by the secular clergy (who held the image of the Virgin in their custody to gain greater influence in the social and religious life of New Spain). In fact, by the 18th century, the Virgin of Guadalupe had become the most venerated image in New Spain and was chosen as the city's patron saint in 1737.

In this competition among engineers, friars, and bishops, it seems that the Virgin of Guadalupe was the one who delivered the best results. The Nochistongo Cut was not enough to drain the water, and much work still needed to be done to make the city more resilient to flooding. Thus, only a supernatural intervention could put an end to the flood of 1634.

6 Conclusion

During the colonial era, science was not so separate from the Catholic faith. Scientific information trickled into Spanish America through books imported from Europe, either legally or illegally. Later, the first printing presses established in New Spain initially disseminated Christian knowledge controlled by the Church, which had two mechanisms of control: the inquisition and the education system.

Throughout the 16th and 17th centuries, the providentialist worldview shaped the lives of Spanish Americans, who had no opportunity to seek alternative explanations for the phenomena they faced. The Church possessed a set of actions and rituals for dealing with disasters. One of the earliest rituals in Spanish America, when a disaster struck, was the rogation procession.

In the 17th century, collective responses to disasters became more organized and structured, until they were directed by the Crown itself through royal decrees specifying the need to hold public rogation processions. One factor that influenced the idea that saints are protectors against certain threats has to do with the fact that several saints have been associated with miracles.

During the colonial period, rational thought and theology intertwined in the interpretation of natural phenomena. Scientific interpretations were infused with religious elements. The worldview and interpretation of earthquakes thus appealed to divine manifestation. However, there were intellectuals who attempted to offer more rational explanations for earthquakes, such as Tomás López Medel, José de Acosta, and Juan de Cárdenas. In the 18th century, José Antonio Alzate y Ramírez offered his interpretation of earthquakes, drawing in his analysis on Lucretius's caves and Seneca's concept of trapped air.

The great flood of 1629–1634 in Mexico City shaped the 17th century in terms of social, religious, and scientific interpretations and debates. This disaster lasted five years and served as a forum for the exchange of ideas among scientists, government officials, engineers, and friars.

This work is framed within a history of ideas, particularly those related to disasters. The colonial era is interesting because it highlights the persistence of the Church's dogmatic ideology in the face of positivist and rational thought championed by a New Spain elite. Although scientific thought had not yet succeeded in understanding the origin of earthquakes, it did prompt the authorities to compile a record of the damage they caused to buildings; and it succeeded in opening a debate between the Church and scientists during the great flood of the XVII. In this way, the myth of the great biblical flood as a divine punishment gradually faded over the following centuries.

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Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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