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Recalibrando el terremoto del 8 de julio de 1730 en Valparaíso, Chile: dando contexto histórico a las fuentes primarias

Recalibrating the July 8th, 1730 Valparaiso, Chile earthquake: giving historical context to primary sources[*]

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RESUMEN:

Este artículo utiliza información histórica recogida de cartas, informes y casos judiciales para reconstruir el daño y los niveles de inundación del terremoto y tsunami que tuvo lugar el 8 de julio de 1730 en Valparaíso, Chile. Se analizó cada informe para recrear la secuencia sísmica del evento y clarificar el periodo de tiempo de llegada del tsunami. Este ejercio demuestra que la región más afectada se extendió entre La Serena y Santo Domingo y no más al sur como previamente se había postulado. Finalmente, se muestra la importancia de analizar cada fuente en su contexto histórico para así entender lo que el autor quiso compartir con su propuesta.

Palabras Claves: Terremoto histórico, tsunami histórica, terremoto de subducción, Concepción, Valparaíso, Chile

ABSTRACT:

This paper uses historical data from letters, reports, and court cases to reconstruct earthquake damage and tsunami flooding levels from the July 8th, 1730 Valparaiso, Chile earthquake. Each selected primary source is analyzed to recreate the seismic sequence and clarify the size and arrival times of the associated tsunami. This exercise demonstrates that the earthquake´s primary damage zone was between La Serena and Santo Domingo and not further South as previously hypothesized. Finally, it shows the importance of analyzing each source in its historical context in order to understand what its author intended to share with his selected audience.

Key Words: Historical earthquake, Historical tsunami, subduction earthquake, Concepcion, Valparaiso, Chile

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Introduction

Analyzing pre-instrumental earthquakes and historical tsunamis based on contemporary written sources is fraught with difficulties and complexities rarely brought to the forefront during the investigative process. They range from locating reliable historical sources, putting them into their correct contexts, interpreting the texts themselves, and inferring what the author meant to communicate to its intended reader.

Answering these questions is part of the essential historical investigative method, that at times diverges from the specific numbers-oriented scientific process. The use of contemporary sources without a correct historical interpretation generates serious problems with their subsequent scientific analysis and propagates erroneous interpretations that are difficult if not impossible to correct. At the same time, a purely historical interpretation of a pre-instrumental seismic event and related tsunami does not allow for its inclusion within the scientific analysis of the region's seismic cycles because in general, the historian´s interests are not scientific, which leads to the unintended omission of relevant scientific data.

Connecting these diverging goals and methods requires alliances between historians and the scientific community which would allow for the correct scientific interpretation of original sources within their proper historical contexts. As with any strategic alliance, both parties would cede part of their methodology and prejudices to produce results accepted by both peer groups. This paper looks to reinterpret one of Chile´s largest pre-instrumental earthquakes in the hope that a better understanding of its colonial documentation will allow for the creation of more concise models of the earthquake´s rupture zone and this region´s seismic cycle[34].

The pre-instrumental, July 8th, 1730 Valparaiso earthquake and tsunami has received a lot of attention as of late as we near its 300th anniversary. The earthquakes extreme size generated a tsunami that devasted the Chilean ports of Concepcion, Valparaiso, and La Serena, while also causing damage in the coastal regions of Perú and Japan[35]. Recent investigations have analyzed numerous historical sources related to this event to locate the earthquake´s rupture zone and

[34] For more information about Chile´s seismic cycles please refer to the following publications: Lomnitz, Cinna. 1970. "Major earthquakes and tsunamis in Chile during the period 1535 to 1955" in International Journal of Earth Sciences 59, 938-960; Lomnitz, Cinna. 2004. "Major earthquakes of Chile: a historical survey, 1535-1960", in Seismological Research Letters 75, 368-378; Udías A., Madariaga R., Bufon E., Muñoz D., Ros M. 2012. "The large Chilean historical earthquakes of 1647, 1657, 1730, and 1751 from contemporary documents", in Bulletin of the Seismological Society of America, Vol. 102, No. 4, pp. 1639–1653, August 2012, DOI: 10.1785/0120110289; Ruiz Sergio & Madariaga Raul, 2018, "Historical and recent large megathrust earthquakes in Chile", in Tectonophysics, DOI: 10.1016/j.tecto.2018.01.015.

[35] Carvajal Matías, Cisternas Marco, Catalán Patricio 2017; Source of the 1730 Chilean earthquake from historical records: Implications for the future tsunami hazard on the coast of Metropolitan Chile", *Journal of Geophysical Research: Solid Earth*, 122, pp.3648–3660

describe its probable intensity[36]. While these investigations resulted in a somewhat homogenized seismic sequence, they differed on their assessment of its tsunami. The historical analysis proposed the extraordinary idea of two separately generated tsunamis and an extensive damage zone of over 1200 kilometers[37].

The separate scientific investigation, the earthquake´s intensity and rupture zone were modeled by triangulating the reported tsunami runup and flooding in the ports of Valparaiso and Concepcion, and the coast of Japan. Their analysis placed the quake´s intensity at around M_W 9.2[38]. However, this investigation did not consider the possibility of two independent tsunamis or that a tsunami could have been generated by the weaker foreshock, which directly contradicted the previously published historical evaluation.

Another recent investigation expanded and marked the tsunami flood zone in Concepcion, creating a far more detailed picture of the tsunami´s destructive path within the city. At the same time, this investigation revealed that the buildings in Concepcion and in the region around the city itself did not suffer notable earthquake damage[39]. For that matter, they did not even report earthquake damage, which further puts into perspective the need to recalibrate this specific historical earthquake´s intensity and rupture zone, since all the earlier investigations inferred that the city was heavily damaged by the earthquake´s shaking[40].

This paper will analyze the use of historical documents to answer three simple, but important facts, relating to the July 8th, 1730 earthquake. First, the chronological sequence of the main shocks and their respective intensities. Second, which of the reported seismic events generated the tsunami or tsunamis that destroyed large portions of the Chilean Coast? A lastly, the geographical extension of the quake´s intensity based on reports of damaged structures[41].

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[36]Carvajal, Matías, Cisternas, Marco, Catalán, Patricio, & Gorigoitía, Nicolas. 2014. "Redimensionando el terremoto de 1730 de Chile central, mediante evidencias históricas y geológicas del tsunami resultante", VIII SLAGF y IV SIAGF. Simposio Latino-Americano de Geografía Física—Simposio Ibero-Americano de Geografía Física "Riesgos, vulnerabilidades y resiliencia socioambiental para enfrentar los cambios globales", pp. 1134-1142; Carvajal, Matías; Cisternas, Marco; Catalán, Patricio; Gorigoitia Nicolás. 2013. "Estimación de la magnitud del terremoto de 1730 de Chile Central, mediante modelación numérica, crónicas históricas y evidencias geológicas de su tsunami", *Anales de la sociedad Chilena de Ciencias Geográficas*.

[37]Urbina Ximena, Nicolas Gorigoitía y Marco Cisternas. 2016. "Aportes a la historia sísmica de Chile: El caso del gran terremoto de 1730", *Anuario Estudios Americanos*, 73(2), 657–687;

[38]Carvajal .2017. "Source of the 1730 Chilean earthquake from historical records"

[39]Stewart, Daniel. 2019. "Historical tsunamis in the Concepcion Bay, as seen in the reconstructed flood levels from the colonial city of Concepcion (Penco), Chile (1570-1835)", *Revista Historia*, N°26, vol. 2, Julio-Diciembre 2019, p. 97-127.

[40]Carvajal. 2014. "Redimensionando el terremoto de 1730 de Chile central"; Carvajal, Matías; Cisternas, Marco; Catalán, Patricio; Gorigoitia Nicolás. 2013. "Estimación de la magnitud del terremoto de 1730 de Chile Central"

[41] For this investigation, structures could be either urban or rural. In general, we have more information about chapels and convents both of which were solidly built. We also have information about damage to farm buildings and urban dwellings.

Previous interpretations of contemporary historical documents related to this earthquake have demonstrated that answering even these simple questions is not as easy as it seems[42]. To answer the first two questions, we have selected eight letters or reports directly related to the events of July 8th, that were written as close to the event as possible by people who actively participated in the events they were writing about. We will use their testimonies to outline the earthquake´s three main seismic events and the timing and size of the generated tsunami or tsunamis. The quake´s damage zones will be evaluated using all the known damage reports and historical sources, which include letters, summaries, notary records, and testimonies from civil and criminal court cases.

The eight primary sources that serve as the base for this investigation can be described in the following contexts: a short letter written by the military commander in Concepcion to the Spanish Governor describing what had occurred in Concepcion, a declaration by the Santiago City Council for their record books, a letter written to the Peruvian Viceroy by the Spanish Governor, letters written by the Bishops of Concepcion and Santiago, descriptions of the events surrounding the earthquake written by an Jesuits from Santiago and Concepcion, and lastly a chronicle written by a Jesuit priest. These sources provide detailed accounts of what occurred on July 8th and can be used to reconstruct that day´s events. They also represent all the early firsthand reports that we have located that speak directly about the earthquake and tsunami. As mentioned above, later damage reports from specific farms and religious orders will also be taken into consideration when mapping the earthquake´s intensity and the tsunami´s flood zone.

Our analysis of these primary sources will consider a few specific details that are inherent to correctly interpret the written texts. First, we will take into consideration when the document was written. This is important for many reasons, first letters written within a few days or weeks of the earthquake contain specific details about a small number of localities, while a letter or report submitted later generally contains less detailed information from a much larger geographical area. At the same time, letters written from Santiago within days of the earthquake, before communication was restored between Santiago and the rest of the country, contain suggested damage reports for southern Chile that were later proved incorrect once the lines of communication were restored. Therefore, understanding when these lines of communication were restored is key to correctly interpreting the written text.

Next, we need to consider the text´s intended audience and primary author. Today´s archives contain letters, reports, court cases, books, and even random documents all of which

[42] Palacios Roa, Alfredo. 2012. "Sismicidad histórica de la ciudad de Concepción desde su fundación en 1550 hasta su traslado en 1751, Servicio Nacional de Geología y Minería, Chile, Boletín, No. 64; Onetto Mauricio. 2007. *Temblores de tierra en el jardín de edén. Desastre, memoria e identidad: Chile, siglo XVI-XVIII*. Santiago, DIBAM, Centro de Investigaciones Diego Barros Arana.

have been taken out of their original contexts and placed into storage with artificially created indexing systems. Military, civilian, and religious leaders had vastly different world views that are clearly visible in their preserved formal and informal writings. A short letter between a military commander and the Spanish Governor contains vastly different information than a letter from a Catholic Bishop to Spanish King, even when both are describing the same sequence of events. In this case, the first was directly related to the daily administrative needs of his jurisdiction during the initial earthquake response, while the second was an attempt from countries leading religious leader to receive a transfer to another Diocese where the economic situation was not so dire.

Lastly, while most letters were individual in their authorship and firsthand information, Jesuit reports and letters from the Spanish Governor contained numerous partial firsthand and secondhand accounts and thus would be prone to alterations or temporal mixing of events. While these large compiled reports provide a broad overview of the earthquake´s destruction and social impact they should not be considered individual firsthand accounts. Each of these points will be considered in our analysis of the selected primary accounts.

Written sources for the July 8th, 1730 Valparaiso, Chile Earthquake

Maestre de Campo Manuel de Salamanca: July 10th, 1730[43]

The earliest written report that we have located comes from Manuel de Salamanca who at the time was serving as the commander of the Spanish Army in Chile and the military governor of the port of Concepcion. His letter written on July 10th, two days after the earthquake, refers directly to the city of Concepcion and the damage that he observed on the morning of July 8th. It is the only immediate firsthand report that we have for events of that day and subsequently does not refer to other localities within the jurisdiction of Concepcion.

He reported that the earthquakes or tremors started around 1 AM on the morning of July 8th, and had been followed later by a tsunami, whose waves kept coming until around 4 PM on the same day. He related how the tsunami´s first wave had caught him by surprise and forced him to retreat to higher ground without having time to get dressed or even put on his shoes. He recounted that after the water from the initial wave had receded, he returned with a few of his officers to the barracks to retrieve some of their personal belongings and essential military equipment.

The incoming second wave ended their efforts to recover the garrison's weapons and munitions from the damaged military storehouse. As the water level was quickly rising, he

[43]Palacios Roa Alfredo. 2016. *Fuentes para la historia sísmica de Chile (1570-1906), estudio preliminar, selección, transcripción y notas*, Fuentes para la historia de la República Volumen XLI, DIBAM, Chile, 2016, pages 113-114; Archivo Nacional Histórico de Chile, Fondo Claudio Gay, vol. 18, pages 162-163.

heard cries coming from the city´s jail, upon entering the already teetering structure he found that the prisoners had been abandoned in their cells during the tsunami´s first wave and were now in peril of drowning. Upon releasing the prisoners, he waded through the now waist deep water to his horse and finally reached higher by cutting across the main plaza and climbing the hill to the Hermita Chapel.

His report is clear and concise in what it tells us but at the same time, creates many potential questions. What is evident, is that for him, the tsunami and not the earthquake was the day´s main event. So much so, that he never suspected that the seismic shaking that he had felt could have caused a tsunami. Furthermore, his use of the word "temblor" or tremor instead of "terremoto" or earthquake clearly shows the quakes reduced intensity in the city of Concepcion.

Since at this time he had not received any news from outside of the city itself, his letter was meant to calm any fears the Governor in Santiago, whose condition he did not know, would logically have had about a possible Indian uprising by informing him that they had been able to save part of the garrison's weapons and munitions and had regrouped on the hills outside of town.

Santiago Town Council: July 19th, 1730[44]

The second written report that we have related to the earthquake is found in the Santiago Town Council minutes from July 19th, where the mayors and town council members wrote that a large earthquake occurred at 4 AM on the morning of July 8th and had destroyed the entire city. This first mention of the earthquake in the Town Council´s records served as a marker for future decisions during the reconstruction process and includes a list of specific civic buildings that needed to be rebuilt. It gives few details because it was written in a small book by a scribe who was explicitly trying to save space and was never intended to be interpreted as a letter or report. Later council meetings spoke in more detail about the reconstruction of specific civic and religious buildings but, give no further details about the quake itself.

Chilean Governor Gabriel Cano y Aponte: July 20th, 1730[45]

The third document was written the day after the city council meeting by the Spanish Governor who at the time was living in the city of Santiago. He wrote to inform the Spanish Viceroy in Peru what had occurred in the region of Santiago. He noted that he was still waiting for the

[44]Palacios Roa Alfredo. 2016. *Fuentes para,* p. 114; "Actas del cabildo de Santiago, 19 de junio de 1730", Colección de historiadores de Chile y documentos relativos a la historia nacional (Santiago, Sociedad Chilena de Historia y Geografía, 1982), tomo LIII, p. 66.

[45]Palacios Roa Alfredo. 2016. *Fuentes para.* p. 114-116; AGI.CHILE vol. 27, fojas 32-34v. Copias manuscritas en Chile en Archivo Nacional Histórico, Fondo Vicuña Mackenna, vol. 304-c, fojas 249-255 y en Biblioteca Nacional, Manuscritos Medina, tomo 177, pieza 3874, fojas 229-234.

arrival of the supply boat from Concepcion to receive news about that city´s fate, but he assumed it too had been destroyed by the earthquake and tsunami.

His report included his own firsthand experiences and details from some of the damage reports he had received from within the region of Santiago. Thus, this text contains first and secondhand information and covers a much larger geographical area than the previous two.

He reported that he felt the first quake in Santiago between 1 and 2 AM and that it lasted for around 15 minutes. He said it caused little if any structural damage, but it had scared the general population because of its length, leaving many people awake in their beds. A second much larger earthquake or mainshock was later felt around 5 AM. He inferred that it was of a similar length as the first one, however this second shock, unlike the first, destroyed most of the city´s adobe and stone buildings. Later a third large shock was felt around 12 PM that further damaged the city´s structures.

He also reported that between the July 8th and July 20th there had been many aftershocks, three of which were of considerable strength. Additionally, the situation in Santiago had become quite critical because abnormally heavy rains had started two days after the earthquake and had persisted for over 24 hours. The rains had further damaged the city´s remaining structures and had triggered heavy flooding within the urban core.

Next he made reference to reports that he had received from Valparaiso that indicated that the earthquake had destroyed most of the city´s buildings, and that a large tsunami had entered into the city and destroyed the warehouses and docks, where all the region´s agricultural products were stored in preparation for shipment to Perú. He then cited other reports that informed him of the paralyzation of the mining operations in the regions of Illapel, Petorca, and Tiltil due to the destruction of the ore processing mills and tunnels during the earthquake.

The governor's letter was a direct call for financial and material assistance and had two intended audiences. The first was the Viceroy of Peru who would lead the regional reconstruction efforts through the reallocation and reduction of local taxes and the shipment of emergency relief supplies. The second intended audience was the Spanish King who would need to authorize the funding for the reconstruction of the larger government and religious buildings such as the royal palace and catholic cathedral.

The regional damage details were carefully selected to show that Chile´s two main sources of fiscal income, mining, and agricultural exports, had been severely damaged and would not be able to finance the reconstruction. That said, the report provides us with a clear outline of the seismic sequence seen on July 8th, a northern expansion of the damage region to the mining center Illapel, and lastly an inferred connection between the earthquake, the tsunami, and the abnormally heavy rains that followed.

Francisco Antonio Escandon Bishop of the Diocese of Concepcion: August 20th, 1730[46]

The next report that we have comes a month later, on August 20th in the form of a letter from the Bishop of Concepcion Francisco Antonio Escandon to the Spanish King. He starts by saying that the first earthquake was felt throughout the country around 1:30 AM and that it didn't cause any damage in Concepcion[47]. He laments that he was not able to recognize that the earthquake was a sign of a future tsunami. He then mentioned that the city was hit by four or five large tsunami waves of which the third was the largest. He then wrote that around 3 AM a second earthquake shook the city which made standing difficult[48]. Then almost as a side note or as a correction of what he had written previously, he stated that the tsunami that he had described in the previous paragraph was caused by this second earthquake and not the first.

He then explained how he had left his house when the tsunami was already entering the city and that when the alarm was sounded, he was in his bed sleeping. Lastly, he related that the tsunami took about one hour to fill the city with water before it finally receded. The rest of his report detailed his attempts to locate his belongings and how the tsunami had left him and the city destitute and without the basic resources needed to rebuild or sustain life[49].

There are notable differences between this report and those written earlier in July. First communication had reestablished between Concepcion and Santiago which made some portions of his report global and not specific to the city of Concepcion. And second, while the Bishop was informing the King of the events that had occurred in Chile, his goal was to show his own precarious financial and physical situation in order to receive a transfer in his clerical duties, which luckily for him was approved within a few days of his letter arriving in Madrid.

The other key detail in this report was the fact that the Bishop, whose palace was located directly on the beach, was sleeping when the tsunami started and had to roused by military officials and neighbors pounding on his door as the water level rose outside. This confirms that the tsunami did not immediately follow either of the first two earthquakes since he had time to fall back asleep before its arrival. He declared that the tsunami followed the second quake, which he placed at around 3 AM. In this case it would further show that not even the larger mainshock was intense enough in Concepcion to arouse an adult from his bed, which explains

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[46] Palacios Roa Alfredo. 2016. *Fuentes para.* p. 117-119; AGI.CHILE vol. 27, fojas 1-7. Copia manuscrita en Chile en Archivo Nacional Histórico, Fondo Vicuña Mackenna, vol. 304-c, fojas 257-267. Esta misiva también fue transcrita y publicada por Raïssa, Kordic. 1990. "El terremoto de 1730 visto por el obispo de Concepción Francisco Antonio de Escandón", *Cuadernos de Historia*, No 10, pp. 209-225.

[47] The bishop´s opening statement clearly shows that by this time he had received news about the earthquake´s damage in the rest of Chile.

[48] He described that the earthquake made standing difficult which on the Modified Mercalli scale corresponds to a VII. The witnesses in Santiago described by thrown violently to the ground which would by at least a IX on the same scale.

[49] The Bishop´s palace was located directly on the beach and thus was one the buildings hardest hit by the tsunami. Very few of the Bishop´s material possessions were ever recovered.

the Bishop´s initial apologies where he confessed that he should have known that the earthquake would have caused a tsunami.

Unknown Jesuit Author: Santiago October 12th, 1730[50]

This report is the first of two that were sent to the leaders of the Jesuit religious order as part of the 1730 Chilean annual letter. A previous analysis of these reports by the historian Jaime Valenzuela described their nature, composition, and rhetorical characteristics[51]. To summarize his observations, we can call these two reports, not purely as damage reports but as synthesized religious sermons whose main intent was to show the blessings and punishments of God through the events of July 8th and the two cities present paths of repentance and redemption. They included a mixture of first and secondhand accounts and damage reports from other Jesuit installations within Chile.

That said, the Jesuits described the first earthquake in Santiago as being just after 1:30 AM and while being soft and smooth, its movements served as a warning of things to come for the city´s inhabitants. Less than three hours later a massive earthquake destroyed most of the city´s buildings. The author described this earthquake as the largest in the city´s history, in direct comparison to the massive 1647 quake. As in the other reports for Santiago, the writer said that the earthquake was followed a few days later by a massive 24-hour long rainstorm that pulverized many of the remaining adobe building´s damaged walls and at the same time causing catastrophic flooding along the city´s rivers and canals. Lastly, the author estimated that between July 8th and October 12th that there had been over 400 aftershocks, five or six of which were similar in size to the mainshock, causing notable further structural damage within the city[52].

The author then mentioned that other cities such as Concepcion, La Serena, Quillota had been severely damaged by the earthquake or the tsunami, however, he chose to describe what had occurred in the port of Valparaiso, which at this time was little more than the official port of the city of Santiago. First, he confirmed that earlier large earthquakes, such as the 1647 Santiago earthquake and the 1657 Concepcion earthquake, had not caused visible tsunamis in Valparaiso, but that this one had formed a wall of water 3.5 meters higher than the normal high tide which had flooded the port installations and the low-lying sectors of the town. He then described which buildings were and were not touched by the water, which allowed

[50]Palacios Roa Alfredo. 2016. *Fuentes para.* p. 131-141.

[51]Valenzuela, Jaime. 2012. "Relaciones jesuitas del terremoto de 1730: Santiago, Valparaíso y Concepción", en *Cuadernos de Historia*, 37, Santiago, p. 195–224.

[52] Based on the Governor´s report and this Jesuit report we can assume that between July 20th, and October 12th, the city of Santiago felt two or three large aftershocks as well as hundreds of smaller ones.

investigators to map the tsunami´s runup in Valparaiso[53]. He further confirmed that earthquake destroyed most of the city´s buildings, just as it had done in Santiago.

As we described above, the Jesuit authors intended audience were the Religious Order´s leaders in Rome. They were interested in documenting the Order´s missionary efforts in America and the physical evidences of God´s miracles among his people. However, at the same time, this annual report was intended to show the financial losses that the order had suffered in Chile, without mentioning them directly. By this time it was well known that the Jesuits were one of Valparaiso´s largest exporters of agricultural products, which made them one of the hardest hit financially with the loss of the harbor warehouses full of grain, hides, and tallow waiting to be exported to Peru.

Unknown Jesuit Author: Concepcion October 1730[54]

This long-detailed report or sermon was the Concepcion Jesuits contribution to the 1730 annual report. We assume that it was written by a friar living in the Concepcion Convent, however, the text itself does little to reveal his identity. As with the report by the Santiago Jesuits, it is a mix of specific details and religious connotations generally referring to the events surrounding the earthquake and tsunami in the city of Concepcion.

Internal Jesuit records from the Concepcion Convent show the detail and precision that these reports were written and that in general numerous drafts were needed to create the perfect text. That said, this report shows first the inclusion of a larger amount than normal of biblical stories and some confusion in the historical events that were separated within the text by large sections of religious explanations and quotes. Unfortunately, in this report, there are a few chronological inconsistencies that were not corrected in the draft process.

The author or authors mentioned that the first quake was felt at 1 AM. They described it as a long nonviolent movement that did not cause any damage within the city. Like the Bishop of Concepcion, they expressed regret and said the first quake should have been taken as a sign of things to come as it had been in Santiago. While referring to the missed physical signs of the impeding tsunami, they cited reports that on the night of the earthquake fishermen had gone to investigate their nets and noticed that the water was receding out the bay. The fisherman recognized this as a sign of an impending tsunami and tried in vain to reach the city to raise the alarm. Some of them, still in their small boats, rode the tsunami´s first wave into town where they raised the alarm amongst their neighbors in the Cantarranas neighborhood.

On the Jesuit´s side of the river, they mentioned that Manuel de Salamanca and other soldiers raised the alarm of the incoming water. They also clarified that the Bishop did not want

[53]Carvajal Matías, Cisternas Marco, Catalán Patricio 2017. “Source of the 1730 Chilean earthquake from historical records”

[54]Valenzuela, Jaime. 2012. “Relaciones jesuitas del terremoto de 1730”, p. 195-224.

to leave his palace, that was located directly on the beach, but fortunately for him, he was convinced otherwise. They also revealed that many people stayed in their homes during the tsunamis first wave, only to flee during the next much larger one. Most of these stragglers were forced to wade through waist-deep water before reaching higher ground on the hills surrounding the town.

The Jesuits, Bishop, and military leaders gathered the townspeople on the hill next to the Hermita Chapel. They recalled that by early morning light they were able to see the bay and approaching tsunami. They recalled the Bishop´s instructions to retrieve the sacred images from the Cathedral and damaged convents and how the soldiers from the town´s small garrison formed a procession carrying the images through the deep water of the plaza and up the hill to the Hermita Chapel. After this was finished a third large wave crashed into the town. As a side note, they mentioned a second early morning earthquake that was followed by the water receding out of the bay again. They finish by mentioning that there were numerous aftershocks and that the waves kept entering the town during the rest of the day. As in Santiago, a large rainstorm started the day after the quake and last several days.

This Jesuit report, as with all previous Jesuit report, was a summarized meshing of first and secondhand sources. They clearly used as primary sources the Maestre de Campo´s and Bishop´s letters as well as oral reports from local fishermen from the far side of town. Since there is no definitive author for the text itself it remains unclear if he was even present in Concepcion at the time of the events. The text itself does not include events written in the first person, which either shows a group writing effort or an author who was not present for the events he was describing. That could explain the discrepancies related directly to the generation and propagation of the tsunami on July 8th. This report has been used to infer that there were two separately generated tsunamis, and not a single tsunami generated after the mainshock as reported by the bishop. Then again, if the authors were using the Bishop´s letter as source material, they might easily have passed over his correction as to the timing of the tsunami.

Alonso del Pozo y Silva Bishop of the Diocese of Santiago: February 20th, 1731[55]

The next report comes from Alonso del Pozo y Silva who at the time of the earthquake was the Catholic Bishop in Santiago. He wrote what can be considered an exit report or final state of the Diocese upon receiving a transfer to the city of Caracas. His report is based first on his own experiences, with the inclusion of other witness testimonies.

He stated that on July 8th there were three large earthquakes over a 12-hour period. The first was between 1 and 2 AM which he described as being long and nonviolent. He admitted

[55]Palacios Roa Alfredo. 2016. *Fuentes para.* p. 120-124.

he wasn't sure if he should get dressed and leave his house, which in the end he chose not to do.

The second earthquake was a 3:45 AM and threw him from his bed violently to the floor while destroying the city´s buildings and walls. He then related as the morning was finally clearing up, between 12 and 1 PM, a third earthquake struck the city just as strong or stronger as the second one, but luckily not as long lasting. Finally, that over the next months there were numerous aftershocks of differing intensities and lengths.

While his report was sent directly to the Spanish King, a copy assuredly reached the hands of José Manuel de Sarricolea y Olea who came from Tucumán to replace him as the Bishop of Santiago. It is unclear why a report was not sent earlier, however, it is understandable considering the deplorable condition that the earthquake left the city of Santiago and the general lack of maritime traffic between Valparaiso and Santiago during the winter and spring months.

Jesuit Priest Miguel de Olivares: 1736[56]

This Jesuit priest, who is presumed to have been stationed in Concepcion during the earthquake, is the probable author of one, or both, of the Jesuit annual reports. In 1736, he published a history of Chile where he described in general terms the earthquake and connected tsunami. He wrote that a major earthquake was felt in Santiago and Concepcion at 4 AM causing major damage in Santiago but no damage in Concepcion. He then wrote that a large tsunami appeared in Concepcion, whose second wave was the biggest. Also, he described the view looking down from the Hermita hill in the morning after the earthquake as seeing a big lagoon that covered most of what had once been the city. Lastly, he confirmed that the tsunami had flooded a large part of the port of Valparaiso, where he was later stationed while he was finishing writing his book.

While the book of Miguel de Olivares is not the only Chilean chronicle to mention the earthquake, it is the only one whose author is known to have participated in the mentioned events. He connected the tsunami to the main earthquake and confirmed that the second wave was the largest.

Seismic sequence

The July 8th, 1730 Chilean earthquake gives us a unique opportunity to analyze the scientific complications that arise from using historical texts to recreate a coherent sequence of events related to a specific pre-instrumental earthquake that involved more than one major locality. Each of the eight witnesses gave somewhat differing accounts as to the timing of the main

[56]Olivares, Miguel. 1873. *Historia de la Compañía de Jesus en Chile (1596-1736),* Colección de Historiadores de Chile, vol. 7, Imprenta Andrés Bello, Santiago.

seismic events. Most generalized the times by saying that the events occurred around 4 AM or between 1 and 2 AM. Understanding that the modern concepts of time and its importance are not present in historical texts forces us to accept that close approximations, in general, are what is available. Furthermore, from a historical vantage point, reports or letters with specific recorded times should only be considered approximations and not an instrumental reading, unless otherwise noted by the original author.

Table 1: Approximate times for the seismic events of July 8th, 1730

	First Event	Second Event	Third Event
Military Commander	1 AM	-	-
Santiago Town Council	-	4 AM	-
Spanish Governor	1-2 AM	5AM	12 PM
Bishop of Concepcion	1:30 AM	3 AM	Aftershocks
Jesuits Santiago	1:30 AM	Before 4:30 AM	Aftershocks
Jesuits Concepcion	1 AM	Early Morning	Aftershocks
Bishop of Santiago	1-2 AM	3:45 AM	12-1 PM
Jesuit Priest	-	4 AM	-
Estimate	1:30 AM	4:00 AM	12:00 PM

Source: Palacios Roa, Alfredo. 2016. *Fuentes para la historia sísmica de Chile (1570-1906)*, DIBAM & Centro de Investigaciones Diego Barros Arana, Chile, 2016, pages 113-141.

Six of the eight witnesses placed the main foreshock of the earthquake as occurring between 1 and 2 AM of the morning of July 8th. Only two gave a specific time of 1:30 AM, which can place an approximate time for this event. Because of the inexactness of the reports we are unable to differentiate the reported times in Concepcion and Santiago. This foreshock was commonly described as being long but not violent in both localities.

The same six witnesses also mentioned the second mainshock that occurred between 3 and 5 AM, with one witness placing it at 3:45 AM. Those witnesses placed this event as the mainshock, while two witnesses from Santiago, mentioned the third event between 12 and 1 PM which they described as being as big or bigger than the second one. Other witnesses placed this third earthquake into the general category of aftershocks. They reported that in the months after the initial earthquake there had been hundreds of aftershocks, five or six of which were described as large and destructive.

Table 2: Damage reports in Santiago for the July 8th earthquake

	First Event	Second Event	Third Event
Santiago Town Council	-	Heavy Damage	-
Spanish Governor	No damage	Heavy Damage	Heavy Damage
Bishop of Concepcion	No damage	-	-
Bishop of Santiago	No damage	Heavy Damage	Heavy Damage
Jesuits Santiago	No damage	Heavy Damage	Heavy Damage
Jesuit Priest	-	Heavy Damage	-

Source: Palacios Roa Alfredo. 2016. *Fuentes para la historia sísmica de Chile (1570-1906)*, DIBAM & Centro de Investigaciones Diego Barros Arana, Chile, 2016, pages 113-141.

The Catholic Bishop of Santiago described the foreshock as alarming but not strong enough to get him to leave the relative comfort of his bed. The Spanish Governor confirmed this description by saying that while it lasted nearly 15 minutes, the only thing scary about it was its length. Therefore, we can assume that little if any structural damage occurred from this foreshock in Santiago.

This differs from the mainshock, where the Santiago City Council, wrote that everything was destroyed. The Bishop placed the length of the main event at around 15 minutes and confirmed that the quake´s intensity had toppled most of the city´s buildings, including severely damaging all of the city´s chapels and convents. Later reports and summaries refer to the 4 AM quake as being the destructive mainshock. That said, the two detailed descriptions that we have for Santiago refer to the third shock as being as strong and destructive as the second one, just not as long lasting.

The Jesuits in Santiago described the destructive nature of the second earthquake while lumping the third event into the general category of aftershocks. They mentioned that in the three months after the earthquake they had felt over 400 aftershocks, five or six of which were as strong as the initial mainshock. They also expanded the earthquake´s destructive path by describing liquefication in the valley´s to the Southwest of Santiago and the destruction of Valparaiso by the earthquake and connected tsunami.

The descriptions of the shake´s intensities in Concepcion differ greatly from those of Santiago. This is to be expected as early investigations have placed the epicenter or area of the earthquake´s highest intensity near present-day San Antonio, just south of Valparaiso. The first quake or tremor as it was described by the Commanding Military Officer did not ever raise an alarm in the town and no damage was reported. The mainshock was reported as being intense and causing people to lose their balance, but yet again no specific earthquake damage was reported. At the same time, most of the town´s inhabitants chose to not even leave their homes

or in some cases even get out of bed after the mainshock. The third event was not even clearly mentioned, and if it was felt, it was grouped within the vague reference of numerous aftershocks.

Table 3: Damage reports for Concepcion for the July 8th earthquake

	First Event	Second Event	Third Event
Military Commander	No damage	-	-
Bishop of Concepcion	No damage	No damage	-
Jesuits Concepcion	No damage	No damage	-
Jesuit Priest	-	No damage	-

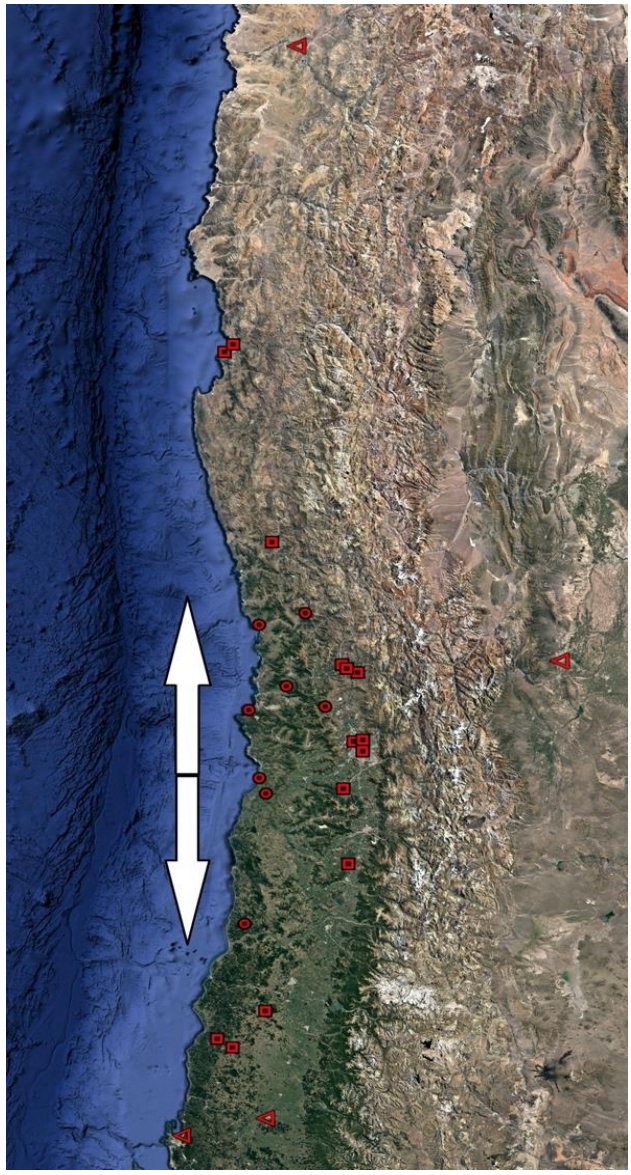
Source: Palacios Roa Alfredo. 2016. *Fuentes para la historia sísmica de Chile (1570-1906)*, DIBAM & Centro de Investigaciones Diego Barros Arana, Chile, 2016, pages 113-141.

General distribution of the earthquake´s intensity

The differing descriptions of the three main seismic events, allow us only to make general assumptions as to the location of their individual epicenters. The foreshock was felt equally in Santiago and Concepcion, placing it somewhere evenly between the two cities. The mainshock would have been located near the present-day port of San Antonio, which would have caused a more intense reaction in Santiago than in Concepcion. The third event probably occurred North of Valparaiso, thus closer to La Serena, which would explain the earthquake damage visible there and its reduced intensity in Concepcion.

The eight witness reports and later damage reports from Chile´s religious orders and civilian residencies allow us to recreate three damage zones or levels of intensity for the 1730 earthquake, without differentiating between the three seismic events. While this system allows for a visible division between areas of destruction it will tend to expand the area of highest destruction, due in large part to the quantity and quality of the historical sources.

Figure 1: Damage zones for the 1730 earthquake



The localities marked with triangles correspond to intensity level 1. Those marked with squares belong to intensity level 2, while the circles show level 3. The White arrows show the approximate location of the earthquake´s rupture zone and area of highest seismic intensity. Source information for data point can be found in Appendix 1 and the end of this paper and their GPS location on the google earth map.

Level 1, MSK Intensity[57] <VI:

This first damage zone or level of reported intensity, shown as red triangles, corresponds to areas where the earthquake was felt with an MSK intensity of less than VI, which generally was not strong enough to cause visible structural damage in most buildings. For example, in Concepcion the mainshock was described as making standing difficult, but not destructive.

On the northern edge of this zone we have the small mining center of Copiapo, whose convents were in found in need of major repairs in 1735, part of which was blamed on the earthquake[58]. However, as of now we have been unable to find further damage reports for the region within the surviving judicial and notary records. We have a similar situation in Mendoza, where during a pastoral visit by the Bishop of Santiago, local officials blamed the cathedrals poor condition on the 1730 earthquake[59]. While no individual damage reports have been located for the region, seismic intensity reports from the recent 1985 and 2010 earthquakes strongly suggest that the 1730 earthquake could have caused structural damage in Mendoza.

On the southern edge of the damage zone we have the cities of Chillán and Concepcion. While no individual damage report exists for either city or any of the hundreds of rural properties that filled the hinterland, a letter from the head of the Franciscan order in Chile included the Chillán Convent in its list of convents damaged or destroyed by the earthquake[60]. In the city of Concepcion any sign of structural damage on the city´s key urban structures would have been lost with the arrival of the tsunami. However, individual reports from outlying buildings and the Mercedian and Domincian convents revealed no reported earthquake damage.

Level 2, MSK Intensity > VII:

This second damage zone or level of reported intensity, shown in red squares, refers to areas where the shaking caused structural damages in churches and other public buildings. Many of these buildings were able to be repaired and did not need a complete reconstruction. While the damage descriptions from this zone are vivid and detailed, they only corresponded to a portion of its buildings which differentiates it from the next section of total destruction.

On its northern edge, we find the port of Coquimbo, the city of La Serena, and a few nearby interior religious convents. In this geographical region we are limited to posterior secondary reports since no immediate firsthand accounts have survived and gaps in the existing city

[57] For a recent example of the scientific application of the MSK intensity scale for a Chilean earthquake refer to: Astroza et al. 2012.

[58] Archivo General de Indias (Sevilla)(AGI)Letter from the Bishop Juan Bravo de Rivera, September 30th, 1736, Santiago, Chile. vol. 150,

[59] AGI.CHILE Letter from the Bishop Juan Bravo de Rivera, October 20th, 1741, Santiago, Chile. vol. 150,

[60] AGI.CHILE, Memorial from Fray Francisco Seco, August 12th, 1731, Santiago, Chile. vol. 145

council minutes do not permit us to see their initial reaction to the earthquake and tsunami[61]. Secondary reports mentioned specific buildings that had suffered damages in the town itself, such as several chapels and convents and a home of a private citizen[62]. These reports allow us to ascertain that the region did suffer widespread repairable destruction from the earthquake.

The region of Maule was also in this zone because of secondary damage reports of the region´s convents and parish chapels. In the years after the earthquake the chapels were repaired, and new towns were formed around them.

The city of Santiago is by the far the heaviest damaged urban center in this earthquake. All its churches and government buildings suffered heavy damage and had to be repaired or in some cases rebuilt. The city council divided the city´s urban core into sections, each member was assigned the detailed revision of a specific section and the power to decide if a damaged wall or building was to be repaired or demolished. Most of the city´s private dwellings were also heavy damaged, yet repairable, since their earthquake´s destruction did not generate a debate over the canceling of religious mortgages or liens placed on urban buildings.

Level 3, MSK Intensity >VIII:

This third damage zone or level of reported intensity, shown in red circles on the above map, corresponds to the earthquake´s probable rupture zone and the area of highest shaking and consequently structural damage. Most of the buildings, bridges, canals, and walls within this area were either completely destroyed or left unrepairable. On modern earthquake maps, this zone would generally correspond to the first isoseismal ring, with an intensity of at least an VIII on the MSK intensity scale.

The zone includes the port of Valparaiso and the coastal region between Illapel and Vichuquen. The northern section includes the mining centers alluded by the governor is his initial report and a Mercedian farm on the coast that was destroyed by the earthquake[63]. The southern limit is defined by the religious installations in Bucalemu and Santo Domingo that were destroyed by the earthquake[64]. The port of Valparaiso also reported the destruction or heavy damage to all its buildings, many of which were further damaged by the tsunami.

[61] The La Serena city council records are in the Chilean National Archive in Santiago, however, the book corresponding to the year 1729-1730 is missing and presumed destroyed in the tsunami.

[62] AGI.CHILE, Letter from Melchor de Jaurigui y Carrera, priest of the La Serena parish, April 14th, 1733, vol. 145; Archivo Nacional Histórico (Santiago de Chile) Fondo Municipalidad de la Serena: (ANH FMS) vol. 5, pages 193-207, naturalization request from Juan Cristobal Borquez, La Serena, 1740.

[63]The buildings in the ranch Guaquén were completely destroyed in the earthquake. Archivo Mercedario Chile, Libros de Administración de la hacienda Guaquén, vol. 13, 16,

[64] AGI.CHILE report from the maestre de campo Miguel de Salinas about the damages that occurred in the ranches of Santo Domingo and Pucauquen, November 25th, 1730, Santo Domingo; vol. 145, Reoprt by fray Juan de Rabanal about the damages suffered in the Bucalemu ranch and convent, Enrich, Francisco. 1891. *Historia de la Compañía de Jesus en Chile,* 2nd volumen, Barcelona, Imprenta de Francisco Rosal.

Tsunami Concepcion

Damage reports and witness statements allow us to ascertain that on July 8th a tsunami was created that caused structural damage in the ports of la Serena, Valparaiso, and Concepcion. It was also reported to have damaged agricultural areas on the coast of Colchagua. Waves were also seen in Callao in Peru and along the Japanese coast. All these references only confirm the presence of the tsunami and unfortunately do not provide times or sequences of events.

The incongruencies in the witness statements from Concepcion make defining the tsunami itself a difficult task. For that reason, we will analyze in detail the four witness statements or descriptions that allow us to recreate a timeline of events in Concepcion. The Jesuit priest Miguel Olivares wrote that a large earthquake was felt in Concepcion at 4 AM and was followed by a tsunami, whose second wave was the largest. He also described how in the morning on July 8th, that the view from Hermita Hill was a city filled with water. He clearly describes one tsunami that damaged Concepcion and Valparaiso at relatively the same time.

The earliest written report that we have from Concepcion was by Manuel de Salamanca, who was serving as the city´s military commander and governor. He wrote that the first quake was around 1 AM and later there was a series of tsunami waves. He said that first wave took everyone by surprise and that those closest to the river fled to the hills without having time to get dressed or to even put on their shoes. He recalls returning to the military barracks to retrieve some of his belongs during which time the second much larger wave caught him near the beach, completely unprepared for a quick retreat. During this second wave, he mentions freeing the prisoners in the city jail and using soldiers to remove some of the garrison's weapons to higher ground. Lastly, he mentions that the large waves finally diminished around 4 PM on the same day.

Bishop Escandon, who was sleeping when the tsunami started, was awakened by loud knocking and yelling, which Salamanca and the Jesuits stated happened during the arrival of the larger second wave. What we can confirm is that he left his palace barefoot and almost naked and had to wade through the water to reach the relative safety of the Hermita Hill. Only much later was he able to return to retrieve a few of his remaining personal belongings.

From the summit of the Hermita Hill above the town, the Bishop and town´s military commander organized the recovery of the churches remaining sacred objects. This occurred when there were still large amounts of water in the plaza itself which leads us to infer that it was during the tsunami´s third wave, which the Bishop described as being the largest.

Tabla 4: Tsunami Water Depth in the city of Concepcion

Locations within Penco:	Reported Water Depth:
San Francisco Convent Inside	1.7 M
San Francisco Convent Outside	>1.7 M
Penco Beach	>8.2 M
Town Jail	>1.0 M
Jesuit Chapel	0.8 M
Jesuit Convent	0.8 M

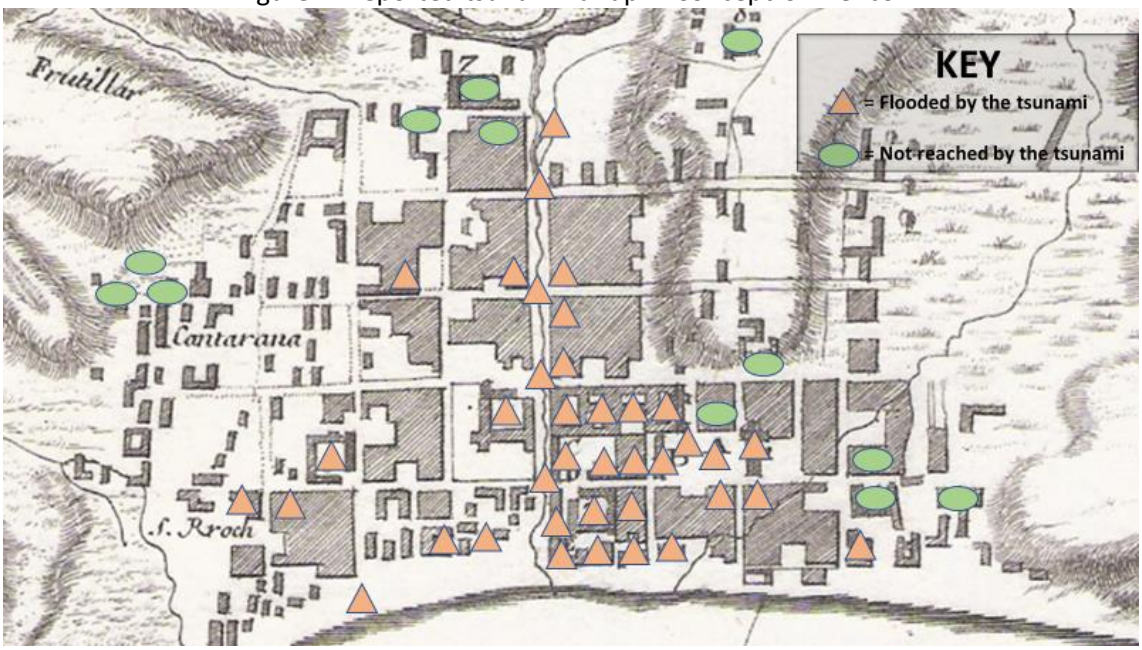
Source: See Appendix 2 at the end of this paper for each individual reference.

While the Bishop´s letter immediately described the tsunami as being four or five large waves, only later to mention the 4 AM mainshock which caused a tsunami. He corrected himself by stating that the before mentioned tsunami was caused by the second seismic event. That allows us to recreate his movements which would place him sleeping in his home at 4 AM and being awaked by the quake only to fall back to sleep and to be reawakened around 5 AM with the first incoming wave or 6 AM with the second. Either of those times would place him on the Hermita Hill before dawn and allow him to organize the removal of the sacred relics upon confirming the tsunamis destructive path and the incoming third wave.

This outline of events better describes the Jesuits written chronology, where they appear to describe a tsunami of unknown chronological origin and then a second much larger tsunami that occurred directly following an early morning mainshock. The Jesuits description places the Bishop and Maestre de Campo on the hill during the mainshock, something that is not possible with their own testimonies. However, referring to Jaime Valenzuela´s analysis of the Jesuit written sermons and episcopal letters the mixing of chronological events would be of little concern[65]. Furthermore, the Jesuits easily could have been referring to a large aftershock that occurred in the early morning hours while they were already on the hill.

[65]Valenzuela, Jaime. 2012. “Relaciones jesuitas del terremoto de 1730”, p. 195–224.

Figure 2: Reported tsunami runup in Concepcion-Penco



Each marked location refers to an individual damage report for the buildings or structures location at that location. The triangles refer to places where the written reports indicate the tsunami reached the structure, while the ovals refer to places where the tsunami is said to have not reached. See appendix 2 for the source material for each data point. Source: Own elaboration from the 1712 map of Concepcion by the French Naval Officer Amadée Francois Frezier.

Conclusions

The July 8th, 1730 earthquake was one of the largest ever perceived in Chile´s historical and instrumental seismic records. The 1:30 AM foreshock can be described as with an estimated intensity of around a V in Santiago and Concepcion, with it being slightly stronger in Santiago. The 4 AM mainshock can be described with an MSK intensity of around VI in Concepcion, where people reported having difficulty standing, but no noticeable structural damage, while in Santiago a much higher the MSK intensity VIII is described for the mainshock and one of the proceeding aftershocks.

This differentiation in the perception of the mainshocks intensity reduces the earthquakes proposed damage zone by shifting the southern boundary to the Maule River, thus eliminating the section around the cities of Chillan and Concepcion. This focuses the quakes primary damage zone as the territory between San Antonio and La Serena. This correction also allows

for a better analysis of the 1737 Valdivia and 1751 Concepcion earthquakes, both of which damaged buildings in the city of Concepcion[66].

Lastly, the Santiago mainshock generated a tsunami that was propagated northward toward La Serena and Callao and Southward to Concepcion. Wave modulations for the Concepcion Bay demonstrate that each large wave takes around one hour to dissipate within the enclosed confines of the bay itself. This perfectly aligns with the Bishop´s description of the tsunami´s first large wave and negates the idea that three large waves could have occurred between 1:30 AM and 4 AM. Therefore, we conclude that the July 8th, 1730 earthquake generated one tsunami with its mainshock whose results were seen not only along the Chilean coastline but as far away as Peru and Japan.

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ANH.FVM	Archivo Nacional Histórico (Santiago de Chile) Fondo Vicuña Mackenna: vol. 304-C
ANH.FMS	Archivo Nacional Histórico (Santiago de Chile) Fondo Municipalidad de la Serena: vol. 5
ANH.RA	Archivo Nacional Histórico (Santiago de Chile) Fondo Real Audiencia: vol. 80, 154, 927, 1290, 1376, 1466, 1554, 1591
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Appendix 1: References of earthquake damage

Name: Alcantara
Location: 226174.77 m E 6135846.56 m S
Building Type: Convent-Church
Earthquake damage Level: 3
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Friar Francisco Seco
Quote:

> *…pues quedaron totalmente arruinados los de Campaña, Alcantara, Malloa, Monte, Santa Rosa, Quillota, Chillan, Unigue, Valparaíso…*

Comments: The convent and church were severely damaged, however most of the convent´s buildings were able to be repaired.

Name: Bucalemu
Location: 773291.44 m E 6161507.85 m S
Building Type: Hacienda-Church
Earthquake damage Level: 3
Tsunami: No
Liquefaction: No
Source: Enrich, Francisco. 1891. *Historia de la Compañía de Jesús en Chile.*
Author: Juan de Rabanal
Quote:

> *"En Bucalemu el P. rector Juan de Rabanal […] había levantado un segundo patio, que fue lo único que perdonó el terremoto al derribar gran parte de la iglesia; y paró tan mal lo restante, que fue preciso edificarlo de nuevo"*

Comments: The Jesuita´s ranches in Bucalemu were heavily damaged and needed to be rebuilt. They suffered much more damage in this earthquake than in the 1647 Santiago earthquake.

Name: Cauquenes
Location: 741019.99 m E 6016585.56 m S
Building Type: Hacienda-Church
Earthquake damage Level: 2
Tsunami: No
Liquefaction: No
Source: Archivo Santo Domingo, pieza 45
Author: Fray Francisco Hernández

Quote:

> *…y lo mismo acaeció en la estancia nombra da Cauquenes perteneciente a dicho Convento grande pues se arruinaron todos los edificios de ella…*

Comments: This convent and ranch were located near were the town of Cauquenes was later founded. They were damaged and had to be repaired after the earthquake.

Name: Chillan
Location: 758715.66 m E 5945121.93 m S
Building Type: City
Earthquake damage Level: 1
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Friar Francisco Seco
Quote:

> *…pues quedaron totalmente arruinados los de Campaña, Alcantara, Malloa, Monte, Santa Rosa, Quillota, Chillan, Unigue, Valparaíso…*

Comments: The Franciscan convent from this town appears on the list of damaged convents. However, secondary sources indicate that the town suffered little material damage from the earthquake.

Name: Concepcion-Penco
Location: 679376.90 m E 5932483.64 m S
Building Type: City
Earthquake damage Level: 1
Tsunami: Yes
Liquefaction: No
Source: Olivares, Miguel. 1873. *Historia de la Compañía de Jesús.*
Author: Fray Miguel Olivares
Quote:

> *En esta ciudad de Penco se sintieron los vaivenes de tierra; mas no causó los estragos que en Santiago ni se sabe que derribase una teja; pero lo que no hizo la tierra con su movimiento, lo ocasionó el agua, no habiéndose contenido en los términos que Dios le señaló.*
>
> *Porque á las horas dichas, retirándose el mar por tres veces, volvió con más furia con todo el peso de aquellos montes de agua; i salvando la playa se entró sin resistencia por dicha ciudad i arruinó más de doscientas casas que estaban situadas en lo más bajo de la población i cerca de la playa. De las tres salidas,*

la segunda fue la más tremenda porque avanzaron más sus olas i fue la que causó más daño. Se destruyo el convento de San Francisco, i si iglesia se maltrató mucho; arruinó se la iglesia i convento i hospitalidad de San Juan de Dios; como también la iglesia i convento de San Agustín; el palacio del gobernador i del obispo; a nuestra iglesia no llegó a tocar por estar en lo más eminente de la plaza; pero perdió el colegio muchas tiendas de alquiler que le derribó la avenida, la cual sacó encima de sus olas todas las alhajas que halló en las casas, capaces de bogar sobre ellas. Allí nadaban las camas, las sillas, mesas, las cajas sin que nadie pensase más que en ver por dónde podía escapar, que algunos lo hicieron por las ventanas, porque ya el agua había ganado las puertas i no daba lugar para coger la ropa con que cubrirse, ni menos, i así medios desnudos como los cogió la noticia de la salida del mar, huyeron á los cerros, hasta el señor obispo el doctor don Francisco Antonio Escandón que al presente se hallaba de arzobispo en la ciudad de los Reyes ó Lima, á donde fue promovido desde La Concepción [...].

Comments: This city was highly damaged by the tsunami. The earthquake itself did not damage the city´s structures. The overall lost of structures was placed at 190 buildings or 2/3 of the entire city. The city´s civic center, located between the Cathedral and the Royal Palace was heavily hit, while the Santo Domingo and Merced neighborhoods remained untouched by the tsunami.

Name: Copiapó
Location: 368319.34 m E 6972260.71 m S
Building Type: Convent-Church
Earthquake damage Level: 1
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Friar Francisco Seco
Quote:

…como también los de la Ciudad de Coquimbo, y Copiapó, y los de las Recolecciones, que igualmente fueron arruinados hasta sus cimientos…

Comments: This convent was included on the list of damaged convents. However, no local reference has been located to indicate that the earthquake caused any other recognizable damage.

Name: Coquimbo
Location: 274384.72 m E 6683846.09 m S
Building Type: Church-Port

Earthquake damage Level: 2
Tsunami: Yes
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Friar Francisco Seco
Quote:

> *…como también los de la Ciudad de Coquimbo, y Copiapó, y los de las Recolecciones, que igualmente fueron arruinados hasta sus cimientos…*

Comments: This port was damaged by the tsunami. It formed part of the town of La Serena, whose town minutes from the year 1730 have been lost. For that reason, we do not have a detailed account of the tsunami reached ground in this location.

Name: Curimón
Location: 342022.91 m E 6371327.55 m S
Building Type: Convent-Church
Earthquake damage Level: 2
Tsunami: No
Liquefaction: No
Source: AGI.CHILE vol. 145
Author: Fray Francisco Beltrán
Quote:

> *"el hospicio de Santa Rosa del valle de Curimón arruinado con el terremoto magno de que asimismo dio cuenta esta real audiencia V. majestad para que siendo de su real agrado se sirviese de aprobar la donación del dicho hospicio erigiéndose en colegio de misiones".*

Comments: The convent and church were severely damaged, however most of the convent´s buildings were able to be repaired.

Name: Guaquén
Location: 267735.99 m E 6425833.02 m S
Building Type: Hacienda
Earthquake damage Level: 3
Tsunami: No
Liquefaction: No
Source: Visita, Orden Mercedario
Author: Fray Gaspar de la Barrera
Quote:

> *…También quedó arruinada la hacienda de Guaquén, perteneciente al Convento Grande, según visita provincial entre el 24 y el 27 de septiembre de 1732 a este*

lugar, donde el Padre Provincial fray Gaspar de la Barrera ordena hacer inventario de todo lo que hay "después de la ruina del temblor de ocho de julio de mil setecientos y treinta años en que quedaron derribadas todas las casas de dicha estancia", detallado inventario que sin embargo no da mayores detalles de lo arruinado por el terremoto, ni si hubo pérdidas humanas o animales…"hallo que la Iglesia está demolida, y en el suelo, del terremoto que dos años ha la demolió juntamente con todo el edificio de las casas, y despensa…

Comments: This hacienda was owned and operated by the Mercedian Religious Order in Santiago. Their year inventories describe the damage that was caused by the earthquake. However, they make no reference to the tsunami that assuredly reached the coast at the edge of the hacienda.

Name: Higuerillas
Location: 283614.00 m E 6692222.00 m S
Building Type: Convent-Church
Earthquake damage Level: 3
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Friar Francisco Seco
Quote:

…como también los de la Ciudad de Coquimbo, y Copiapó, y los de las Recolecciones, que igualmente fueron arruinados hasta sus cimientos…

Comments: The convent and church were severely damaged, however most of the convent´s buildings were able to be repaired.

Name: Huerta de Maule
Location: 232993.14 m E 6049434.84 m S
Building Type: Convent-Church
Earthquake damage Level: 2
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Friar Francisco Seco
Quote:

…Y los demás conventos que están en el campo y camino de Penco a esta ciudad [de Santiago], que he visto con prolija atención y cuidado, cuáles son los de Alcántara, Monte, Malloa, Chillán, Unigüe y la Huerta he reconocido su total ruina

de suerte, que están reducidos los religiosos que los habitan a vivir en unas chozas cubiertas de paja…

Comments: The convent and church were severely damaged, however most of the convent´s buildings were able to be repaired.

Name: Illapel
Location: 294091.09 m E 6497355.47 m S
Building Type: Mining Installations
Earthquake damage Level: 3
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Governor Gabriel Cano y Aponte
Quote:

…los minerales de oro de Petorca, Tiltil, y Illapel, y otros han quedado incapaces y sin trapiches…

Comments: This region´s mining installations were destroyed and had to be rebuilt.

Name: La Serena
Location: 282586.48 m E 6688870.90 m S
Building Type: City
Earthquake damage Level: 2
Tsunami: Yes
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Priest Melchor de Jauregui y Carrera
Quote:

"Con el estrago que padeció este Reyno de Chile el año de treinta participamos en esta ciudad de La Serena de sus desusados, y nunca experimentados movimientos; Cayendo á su violencia las casas y lo más sensible los sagrados templos, quedando sin Parroquia para administrar los sacramentos a los fieles […]. La Serena abril 14 de 1733 años".

Comments: The city´s homes and religious buildings were severely damaged by the earthquake and those located on the western edge, outside the periphery walls, suffered the effects of the tsunami. Unfortunately, the town council minutes for the year 1730 have not survived, thus depriving us of a more detailed account.

Name: Malloa
Location: 321004.78 m E 6186956.07 m S
Building Type: Convent-Church
Earthquake damage Level: 3
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Friar Francisco Seco
Quote:

> *…pues quedaron totalmente arruinados los de Campaña, Alcantara, Malloa, Monte, Santa Rosa, Quillota, Chillan, Unigue, Valparaíso…*

Comments: The convent and church were severely damaged, however most of the convent´s buildings were able to be repaired.

Name: Mendoza
Location: 515035.22 m E 6359075.62 m S
Building Type: City-Cathedral
Earthquake damage Level: 1
Tsunami: No
Liquefaction: No
Source: AGI.CHILE vol. 145
Author: Fray Francisco Beltrán
Quote:

> *todo lo que pareció conveniente para el reparo de las iglesias maltratadas con el temblor del año treinta y administré el santo sacramento de la confirmación, como también socorriéndoles con la misión de los tres recoletos de San Francisco que me acompañaron quienes aplicados con infatigable celo al beneficio de las almas y cumplimiento de su instituto no han excusado dar en las ciudades que he visitado, valles y otros lugares de algún concurso en las campañas los santos ejercicios del glorioso patriarca San Ignacio…Por el mes de diciembre de dicho año de 38 pasé la cordillera con algunos peligros así por lo arriesgado de las sendas y caminos como porque la nieve en muchas partes aun no daba libre el tránsito, pero con la ayuda del señor me conduje a la ciudad de Mendoza, capital de la provincia de Cuyo, y hallé su iglesia y matriz por los suelos*

Comments: In 1738 local religious leaders inferred that the poor state of the towns chapels was due to damage from the 1730 earthquake. However, we have been unable to locate an earlier report reflecting the assumption.

Name: Monte
Location: 325477.54 m E 6258615.07 m S
Building Type: Convent-Church
Earthquake damage Level: 2
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Friar Francisco Seco
Quote:

> *…pues quedaron totalmente arruinados los de Campaña, Alcantara, Malloa, Monte, Santa Rosa, Quillota, Chillan, Unigue, Valparaíso…*

Comments: The convent and church were severely damaged, however most of the convent´s buildings were able to be repaired.

Name: Petorca
Location: 313991.44 m E 6427133.50 m S
Building Type: Mining Instalations
Earthquake damage Level: 3
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Governor Gabriel Cano y Aponte
Quote:

> *…los minerales de oro de Petorca, Tiltil, y Illapel, y otros han quedado incapaces y sin trapiches…*

Comments: This region´s mining installations were destroyed and had to be rebuilt. The villages of La Ligua, Cabildo, and Petorca were also destroyed.

Name: Pucauquen-Santo Domingo
Location: 256368.96 m E 6274935.56 m S
Building Type: Hacienda-Church
Earthquake damage Level: 3
Tsunami: Yes
Liquefaction: No
Source: AGI.CHILE vol. 145
Author: Maestre de Campo Miguel de Salinas
Quote:

> *"En la estancia de Santo Domingo nombrada Pucauquen jurisdicción del partido de Rancagua en veinte y cinco días del mes de noviembre de mil setecientos y treinta*

años…a efecto de certificar y poner por diligencia los daños causados en dicha estancia con el terremoto magno del día ocho de julio de el dicho año, y reconocida la dicha hacienda sus edificio y ganados = Vi que una Iglesia que tenían en ella erigida amucho costo y nueva estaba totalmente arruinada habiéndose caído hasta las paredes y cimientos y perdido con su ruina todas las maderas y demás materiales sin haber quedado cosa de algún provecho habiéndose demolido juntamente un Retablo dorado y las imágenes y demás alhajas que dicha Iglesia tenía, y pasando asimismo a reconocer las Celdas Despensas y demás oficinas que amucho costo se acababan de fabricar las halle tiradas por los suelos sin que pueda servir lo que queda de ningún provecho por haberse demolido todas las maderas de suerte que halle viviendo a el R.^{do} Padre Procurador que estaba en dicha estancia, y otros religiosos vi viviendo unos debajo de Cueros y otros debajo de Toldos por no haberle quedado donde acogerse…Santiago de Chile a 20 de Agosto de 1731".

Comments: This hacienda and rural convent located on the coast near Santo Domingo suffered the full brunt force of not only the earthquake, which decimated its buildings, but also the tsunami that wiped out most of the hacienda´s cattle. The earthquake also caused notable coastal deformations in this location, as seen in the formation of a large sandbar in the entrance of their coastal lagoon.

Name: Quillota
Location: 288842.88 m E 6359136.43 m S
Building Type: Convent-Church
Earthquake damage Level: 3
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Friar Francisco Seco
Quote:

…pues quedaron totalmente arruinados los de Campaña, Alcantara, Malloa, Monte, Santa Rosa, Quillota, Chillan, Unigue, Valparaíso…

Comments: The convent and church were severely damaged and had to be rebuilt. No reports have been located from the town itself.

Name: Recolecciones
Location: 347187.54 m E 6302997.24 m S
Building Type: Convent-Church
Earthquake damage Level: 2
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Friar Francisco Seco
Quote:

> *…como también los de la Ciudad de Coquimbo, y Copiapó, y los de las Recolecciones, que igualmente fueron arruinados hasta sus cimientos…*

Comments: The convent and church were severely damaged, however most of the convent´s buildings were able to be repaired.

Name: Renca
Location: 339346.21 m E 6302281.34 m S
Building Type: Church
Earthquake damage Level: 2
Tsunami: No
Liquefaction: No
Source: Medina, Jose Toribio. 1910.
Quote:

> *…y la iglesia parroquial de Renca, se hallan arruinados todos los dichos templos sin que se celebre en ellos el santo sacrificio de la misa. Y los demás templos de esta ciudad se hallan maltratados con el daño que les causó el dicho terremoto de 8 de Julio de mil setecientos treinta…*

Comments: The parish of Renca was one of Santiago´s main rural churches. It had to be rebuilt after the 1730 earthquake.

Name: San Felipe
Location: 338553.04 m E 6375418.82 m S
Building Type: Convent-Church
Earthquake damage Level: 2
Tsunami: No
Liquefaction: No
Source: AGI. CHILE vol. 137
Author: Fray Pedro Romo
Quote:

…Estando viviendo en él, los religiosos conventuales en la observancia religiosa cuando se consideraban más seguros por la firmeza de los edificios, acaeció por el año de treinta el día ocho de julio otro temblor de tierra que causó igual estrago y quedó reducido el convento solo a terreno lleno de los despojos de la ruina pero siempre manteniéndose los religiosos observando del modo posible su sagrado instituto sin que le sirviese de impedimento que estas en la incomodidad resultante…

Comments: The convent and church were severely damaged, however most of the convent´s buildings were able to be repaired.

Name: Santa Rosa de los Andes
Location: 350657.12 m E 6366680.77 m S
Building Type: Convent-Church
Earthquake damage Level: 2
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Friar Francisco Seco
Quote:

…pues quedaron totalmente arruinados los de Campaña, Alcantara, Malloa, Monte, Santa Rosa, Quillota, Chillan, Unigue, Valparaíso…

Comments: The convent and church were severely damaged, however most of the convent´s buildings were able to be repaired.

Name: Santiago
Location: 344326.44 m E 6297126.77 m S
Building Type: City
Earthquake damage Level: 2
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Governor Gabriel Cano y Aponte
Quote:

…se han arruinado generalmente todos los templos, los mas tanto que el reparo es solo nueva redificación y el que no necesitare de esta le será preciso un grande gasto, para ponerse en estado de que se obren los divinos oficios, en el siempre con gran riesgo y desconfianza de que quedan con poquísima firmeza, de los monasterios religiosos han quedado por tierra iglesias, y conventos el de las claras de clamada, y el de las Agustinas, y con precisión el señor obispo de haber sacado

a casas particulares las religiosas donde quedan, y este ha sido uno de los caso de más compunción la Catedral aún no hemos registrado, el estado en que se halla que veo será muy trabajoso, todas las casas de la ciudad la más ruina total, y son muy raras las que se consideran capaces de aderezo, a este miserable estado se vio reducida en un cuarto de hora la ciudad…

Comments: All of the city´s buildings suffered serious structural damages. Some were able to be repaired, however, most were torn down and rebuilt. The town council minutes show that this initial reconstruction process was not completed until around 1738. The destruction in the city itself was greater that the experienced in the 1657 and 1751 earthquakes, but generally less than the destructive 1647 earthquake. This could reflect notable differences in the construction of second floors on residential buildings and the specific characteristics of the earthquake itself.

Name: Tiltil
Location: 320068.18 m E 6337576.87 m S
Building Type: Mining Installations
Earthquake damage Level: 3
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Governor Gabriel Cano y Aponte
Quote:

…los minerales de oro de Petorca, Tiltil, y Illapel, y otros han quedado incapaces y sin trapiches…

Comments: This region´s mining installations were destroyed and had to be rebuilt.

Name: Uñigue
Location: 729528.79 m E 6026728.11 m S
Building Type: Convent-Church
Earthquake damage Level: 2
Tsunami: No
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Friar Francisco Seco
Quote:

…pues quedaron totalmente arruinados los de Campaña, Alcantara, Malloa, Monte, Santa Rosa, Quillota, Chillan, Unigue, Valparaíso…

Comments: The convent and church were severely damaged, however most of the convent´s buildings were able to be repaired.

Name: Valparaiso
Location: 255390.35 m E 6340621.65 m S
Building Type: Port-Convents-Church
Earthquake damage Level: 3
Tsunami: Yes
Liquefaction: No
Source: Palacios Roa, Alfredo. 2016. *Fuentes para.*
Author: Governor Gabriel Cano y Aponte
Quote:

> *…la noticia con que me hallo de Valparaíso es de haberse arruinado enteramente con notable perdida de sus vecinos porque además de los efectos del terremoto se introdujo el mar, y destruyó las más de las bodegas, y porque de esto son los pasajeros testigos oculares…*

Comments: The earthquake destroyed most of the city´s buildings and the tsunami flooded the lower reaches of the port and the Almendral valley.

Appendix 2: Tsunami reference points in Concepcion-Penco

TSUNAMI July 8th, 1730					
Site	GPS Location		Tsunami Damage	Water Depth	Source
Joseph Obando	-36.741503°	-72.993300°	Yes		ANH.GAY vol. 18
Puente Merced	-36.740589°	-72.993514°	Yes		Ibídem
La Planchada Penco	-36.736631°	-72.995925°	Yes		Ibídem
Joseph Garcia de Sobarzo	-36.738272°	-72.998178°	Yes		Ibídem
Pedro Lopez de Asencio	-36.739642°	-72.993642°	Yes		Ibídem
Puente Hospital	-36.737464°	-72.995197°	Yes		Ibídem
Palacio Obispo	-36.737505°	-72.997101°	Yes		Ibídem
Puente Palacio	-36.738478°	-72.994608°	Yes		Ibídem
Penco River	-36.736736°	-72.995438°	Yes		Ibídem
Penco Plaza	-36.738569°	-72.997389°	Yes		Ibídem
Penco San Agustin	-36.736744°	-72.992125°	Yes		Ibídem
Laguna Cantarranas	-36.736044°	-72.991631°	Yes		Ibídem
Palacio Real Penco	-36.738457°	-72.995100°	Yes	>1M	Ibídem
Oficina Veedor	-36.737431°	-72.996592°	Yes		Ibídem
Oficina Municiones	-36.737189°	-72.996739°	Yes		Ibídem
Oficina Caja Real	-36.737272°	-72.996422°	Yes		Ibídem
Hospital San Juan de Dios	-36.737419°	-72.995742°	Yes		Ibídem
Guarnición Penco	-36.737800°	-72.995372°	Yes		Ibídem

Ventura Bello	-36.739342°	-72.994583°	Yes		Ibídem
Cabildo Penco	-36.738350°	-72.996700°	Yes		Ibídem
Seminario San José	-36.739092°	-72.997086°	No		Valenzuela (2012)
Tiendas Plaza	-36.738064°	-72.996622°	Yes		Ibídem
Penco Jesuita Capilla	-36.738813°	-72.996345°	Yes	0,8M	Ibídem
Penco Jesuita Colegio	-36.738717°	-72.995924°	Yes	0,8M	Ibídem
San Francisco Penco	-36.737872°	-72.994308°	Yes	>1,6M	Ibídem
Playa-Marina	-36.734606°	-72.996048°	Yes	8,3M	Ibídem
Capilla La Hermita	-36.743406°	-72.995260°	No		AGI. CHILE vol. 145
Penco Catedral	-36.738814°	-72.997992°	Yes		Ibídem
Convento Santo Domingo Penco	-36.738800°	-72.999581°	No		Ibídem
La Merced Penco	-36.741625°	-72.991975°	No		Ibídem
Gabriela de la Barra	-36.739858°	-72.994314°	Yes		ANH.RA vol. 80
Alonso Córdova Figueroa	-36.738194°	-72.997692°	Yes		ANH.RA vol. 154
Antonio González Barriga	-36.738306°	-72.999650°	Yes		ANH.RA vol. 154
Marcela Quiñones	-36.738800°	-72.994908°	Yes		ANH.RA vol. 927
Juan Francisco González Estrada	-36.739203°	-72.992356°	Yes		ANH.RA vol. 1290
Tienda Ignacio Mier	-36.738064°	-72.996622°	Yes		ANH.RA vol. 1376

Felipe Antonio	-36.735806°	-72.991211°	Yes		ANH.RA vol. 1466
Tomas Zúñiga Carrasco	-36.737131°	-72.988975°	No		ANH.RA vol. 1466
Joseph Araya	-36.737619°	-72.989217°	No		ANH.RA vol. 1466
Catalina Sánchez Amaya	-36.737700°	-72.988897°	No		ANH.RA vol. 1466
Juan Antonio Espineda	-36.737322°	-72.995500°	Yes		ANH.RA vol. 1554
Carlos Mol	-36.739547°	-72.997036°	No		ANH.RA vol. 1591