



The 1948 (Ms 8.2) Lady Caycay Earthquake and Tsunami and Its Possible Socio-economic Impact to Western Visayan Communities in the Philippines

M.L.P. Bautista, B.C. Bautista, I.C. Narag, R.A. Atando & E.P. Relota

*Philippine Institute of Volcanology and Seismology – Department of Science and
Technology (PHIVOLCS – DOST)*

ABSTRACT: The Magnitude 8.2 Lady Caycay Earthquake and Tsunami of January 25, 1948 in west-central Philippines is the second biggest earthquake in the 500-year old Philippines earthquake history. According to archives and catalog, 55 Spanish-era churches in Panay Island were damaged, 17 of which totally collapsed. Two persons were said to have drowned along Iloilo Strait because of tsunami. Seismic instrumentation then was also not as well-developed as compared to present. At that time when the earthquake occurred, World War II just ended and most communities were just starting to recover from the disastrous effects of the war. Reports were quite sparse and oftentimes, damages due to war and earthquake were difficult to differentiate. Just using existing reports, there is a incompatibility between intensity distribution and epicenter location and magnitude. Recently, new archival documents have been unearthed that can be used to re-evaluate intensities and consequently re-estimate magnitude. If data is found sufficient, attempts will be done to re-estimate the earthquake's parameters. Then, ground shaking hazard will be modeled and population centers, key economic points and culturally important structures will be plotted to determine possible socio-economic impacts.

1 INTRODUCTION

On January 25, 1948 at 1:46 AM, a Ms 8.2 earthquake occurred in SW Panay Island. This earthquake is the second biggest in Philippines earthquake catalog and caused damage to the island of Panay in western central Philippines. Tsunami was also reported. This earthquake, although one of the biggest events, has very sparse intensity and tsunami accounts. This may be attributable to the fact that when the earthquake struck, the country was just recovering from the effects of World War II.

When this research was started, the lone original report stated that in Panay Island, “55 churches were damaged, 17 of which totally collapsed and 20 cracked beyond repair”. No specific places were mentioned except for Jaro district in Iloilo City where the church belfry collapsed. At the Museo Iloilo, a picture of the collapsed Jaro Belfry was found and inscribed in the picture is the name of the earthquake as the “Lady Caycay” earthquake. In the Philippines, this is the first earthquake event that local residents gave a name to. Interviews conducted mentioned that the word “caycay” could either be referring to the scratches on the ground similar to those made by chickens which were prevalently manifested on the ground after the events. There was also a mention of a local song which either became popular after the event whose hymn can still be recalled by some elder residents. At the time, people were preparing for a fiesta in the district of Jaro and were practising a song and dance routine when the earthquake occurred in early dawn. The report also mentioned sea waves along Iloilo Strait

causing the deaths of two persons. Meanwhile, Gutenberg and Richter located the epicenter at the town of Anini-y in the province of Antique. Surprisingly, no severe damage was observed in Anini-y.

To determine socio-economic impacts should this earthquake occur again, it is important to determine first the correct earthquake parameters such as epicenter and magnitude which are important inputs to computation of ground shaking and tsunami hazards. Then, after ground shaking hazard has been modeled, the possible socio-economic impact may be inferred by plotting location of population centers and important critical structures. Actual economic costs estimation will not be covered by this current study although that will be the ultimate intention in the future when more data become available. The thorough understanding of the character of the Lady Caycay earthquake is a crucial step in evaluating the seismic hazard of western Visayan communities as this earthquake remains as the most serious earthquake and tsunami threat to Western Visayan islands of Panay, Guimaras and Negros.

2 METHODOLOGY

To evaluate carefully the ground shaking hazard, there is a need to determine the accuracy of the existing earthquake parameters. To do this, there is a need to review original earthquake accounts. The study searched for archival documents and newspaper accounts while actual visits to historical church structures preliminary focused on two Panay provinces, Antique and Iloilo were done. Reports from nearby provinces such as Guimaras, Antique, Aklan and Capiz were collected from written reports from these places. New information which included both damages, tsunami reports and economic loss estimates were unearthed and now provide new information that challenges our understanding of the parameters of this very important earthquake event.

Meanwhile, to standardize the assigned intensity, the intensity assigned was based on the description found in the PHIVOLCS Earthquake Intensity Scale (PEIS). In this scale, at Intensity VIII, belltowers and monuments start to topple down. Using this as basis, the damaged belfries and belltowers were the main keypoints checked during the survey to assess Intensity VIII scale. Any less than that effect would be Intensity VII and more extensive and widespread damage would indicate Intensity IX or higher. Putting these information together and using knowledge of site effects and tectonic setting, the epicenter will be located. After determining the intensity distribution, the instrumental epicenter will be determined and felt areas at various intensity levels will be determined and used to recompute using magnitude-felt area relations developed for the Philippines by Bautista and Oike (2000). Then, the location of population centers and critical structures will be plotted to determine possible socio-economic impacts.

3 DESCRIPTION OF THE EVENT

The January 25, 1948 earthquake happened already after the Spanish era but despite this, the damages attributed to it were mostly on these Spanish-era churches. Hence, the review on intensity reports started with the report in the SEASEE catalog (1985) that stated that 55 churches in Panay Island were damaged, 17 beyond repair and at least two people died along Iloilo Strait apparently due to sea waves.

The Main shock

The earthquake happened on January 25, 1948 at 1:46 AM. Its felt motion lasted from an estimate of one to three minutes and this was followed by a series of felt quakes till 5:52 AM (Manila Times, January 26, 1948). Gutenberg and Richter located the epicenter at 10.5 N Lat; 122.0 E Long and its magnitude to be 8.2. This location plots in the boundary between the Antique towns of Anini-y and Dao (now called Tobias Fornier).

Description of Damages in western Visayas

Western Visayas in this study would refer mainly to the islands of Panay, Guimaras and Negros. Panay would include the provinces of Antique, Iloilo, Aklan and Capiz. In Panay, the effects of

World War II were felt heavily. Despite the Spanish colonizers having left the Philippines for 50 years already when the earthquake struck, the effects of the Lady Caycay earthquake were more distinctly documented in existing Spanish structures specifically in Spanish-era churches. At the time of the earthquake, these historical structures bore the brunt of strong shaking. At the same time, during the Japanese occupation in Panay from 1942 to 1945, these churches, at least in Antique and Iloilo provinces, were either used as military garrison or were burned by Philippine army to avoid being used as garrison by the Japanese. All in all, damages to 15 churches in Panay was estimated by Bishop Cuenco to be P 7 million pesos (Manila Times, January 28, 1948).

a) Earthquake Effects to the Province of Antique, Panay Island

In the province of Antique in Panay Island, damages were seemingly less severe as compared to its neighbour province Iloilo. In the epicentral town of Anini-y, surprisingly no distinct and severe damage was seen in the century-old church, the only confirmed masonry structure existing when the earthquake happened. The church, which was originally built in 1830 was also damaged during WWII (Gallende, 1990). No mention of damage has been encountered in the town of Dao. In other towns in the province of Antique, damages to at least five towns were found in accounts. These towns were Bugasong, Culasi, Pandan, San Jose de Buenavista and Patnongon. The churches of Bugasong, Patnongon and San Jose were said to have been destroyed (Manila Times, January 28, 1948). An interview with an eyewitness in Patnongon, however, said that the church was already in ruins when the earthquake struck. In Pandan and Culasi, the newspaper mentions that more than 50% of the houses were destroyed (Manila Times, January 28, 1948). In the mountain slopes, landslides buried people although the exact place was not mentioned (Manila Times, January 27, 1948).

b) Earthquake Effects to the Province of Iloilo, Panay Island

Most of the significant damages during the research conducted were found in the province of Iloilo, specifically in still-existing Spanish-era churches. Generally speaking, bridges, communication lines, public and private buildings all sustained heavy damages (Manila Times, January 26, 1948).

From the gathered accounts, five of the churches which collapsed or were so severely damaged that they were eventually demolished had been identified. These were the churches in Igaras, San Miguel, Oton and Maasin. According to newspaper accounts (Manila Times, January 27, 1948), the church and convent of the town of Igaras collapsed. The Jaro archives described the damage as "total collapse". The church of Maasin was demolished that presently found in its former place is a school. A new church structure was built beside the former location. Meanwhile, falling debris from the collapsing church in San Miguel fell and killed a policeman doing his rounds when the earthquake struck (Manila Times, January 26, 1948). In the town of Oton, the church which was not destroyed during the war was severely damaged that it had to be demolished. The earthquake also destroyed the tower leaving only two bells and stone stumps (Gallende 1990). A boy was buried in the rubble. Intensity IX was assigned in these places.

The belltowers of the churches of the towns of Alimodian, Duenas, Dumangas, Guimbal, Lambunao, San Joaquin (Figure 1) and in Jaro and Arevalo districts in Iloilo City collapsed (Jaro archives, 1948; Maza, 1987 citing Fr. Juan Fernandez). The famous belltower in Jaro district in Iloilo collapsed trapping four church workers. Fissures were observed in the streets that caused traffic disruption. For the rest of the city, 21 died and 43 were injured while total church damages was estimated at P 200,000 although total damages in the city reached P 1,000,000 (Manila Times, January 26, 1948). The Coronet tower in Arevalo District also collapsed (Manila Times, January 26, 1948). The walls and altar, roofs and belfry of the Molo Church were shattered to pieces (Manila Times, January 26, 1948). In Leon, the old Central School and the back portion of the church collapsed. Damage cost in Guimbal was estimated to be at P 35,000 (Manila Times, January 27, 1948). The churches of Pavia and Tubungan were badly damaged (Manila Times, January 26, 2010). The UNESCO-heritage church of Miagao was severely damaged by the earthquake (Jaro archives, 1948). The newly-constructed municipal building said to have been a complete wreck and damage cost was

estimated to be P30,000 (Manila Times, January 27, 1948). The Spanish-era bridge called Taytay Boni Bridge in Miagao survived the earthquake. The earthquake severely damaged the church and convent of the town of Santa Barbara. The roofs and ceiling collapsed, the communion rails were damaged while a portion of the altar and facade collapsed too. Large cracks were observed in the church. The temporary belfry also collapsed. Damage estimate for the Tigbauan Church was P50,000 (Manila Times, January 27, 1948). Intensity VIII was assigned in these places.

Much part of the province of Iloilo lies in soft ground and one of the possible reasons why the earthquake was called “caycay” was due to the seeming chicken scratches on the ground caused of the numerous fissures especially in the lowlying part of the province, Fissures were observed along the roads from the town of Pototan to Dingle and along the Santa Barbara railroad tracks. Ground disruptions described as “little canyons”, possibly the sandblows, were observed in Pototan, Cabatuan, Dingle, Passi and Calinog (Manila Times, January 26, 1948). A new small brook appeared after huge cracks appeared (Manila Times, January 26, 1948) in the Tiring Landing field, current site of the new Iloilo Airport in Cabatuan. At the San Pedro Fort in Iloilo City, large fissures measuring 4 m wide and 10 meters long opened such that sea water was visible. Estimated damage is about P 10,000 (Manila Times, January 27, 1948). Fissures were noted in the streets of Oton (Manila Times, January 27, 1948).

c) Earthquake Effects to the Province of Aklan, Panay Island

The team was unable to personally visit Aklan but a report from the church of Libacao mentioned that the church which was razed to the ground during the war, was again destroyed by the earthquake. Meanwhile, based on newspaper accounts, the concrete Ibayay Bridge, which costs P200,000 to build at that time, sank two meters deep. Fissures opened and water geysered out from the cracks. Also the approaches to the Calivo (Kalibo) Bridge were also destroyed (Manila Times, January 28, 1948). These two bridges were the biggest in Panay Island when the earthquake struck.

d) Earthquake Effects to the Province of Capiz, Panay Island

Portion of a church in Capiz was damaged (Manila Times, January 26, 1948) although its name was not mentioned, probably it refers to the church at the capital. In Dumalag, a central mill building sustained heavy damage. Some employees were injured.

e) Earthquake Effects to the City of Bacolod, Negros Island

The 1948 Lady Caycay earthquake was believed to have been the most severe earthquake to have been felt in Bacolod City for the last 50 years (Manila Times, January 26, 1948). Articles inside houses and buildings were thrown to the floor and glass windows were broken. During the quake, people inside houses and buildings ran out in panic.

f) Earthquake Effects to the Province of Negros Occidental, Negros Island

As of this writing, aside from Bacolod City, only one other account for Negros Island has been encountered. The account states that the municipal building of Asturias collapsed killing one person (Manila Times, January 26, 1948). Railroad tracks inside the central sugar mill were disaligned when fissures appeared. As a result, the sugar factory was damaged. Other buildings sustained slight damage.

g) Tsunami Reports

Fish corals from the Iloilo shore towns of Oton to San Joaquin were destroyed by tsunami. Damage was estimated to be P 250,000. The fish corals were detached from the log moorings. The

waves did not move inward thereby sparing more damage to life and property (Manila Times, January 27, 1948). Interviews conducted in 2007 among eyewitnesses in Miagao and Tigbauan also confirmed the occurrence of tsunami. In interviews conducted in 2010, veracity of the tsunami was confirmed. In Bgy Purok 1 in the Iloilo town of San Joaquin, Mr Isidro Siva recounted that his friends who were sleeping along the beach when the quake happened woke all wet from the sea water which apparently encroached the beach after the quake. Since the sleeping people were not carried away, then the waves were not that strong. A primary source of the tsunami is Mr Gervacio Evangelista who was 28 years old in 1948. Mr Evangelista was then residing in Bgy Tando in the town of Nueva Valencia in Guimaras Island. During the earthquake, he was on board a boat called “Batel Cornelio” together with five other passengers. The boat was in the shores of Miagao. He recounted that all boat passengers felt the shaking, then they heard a whistling sound. Then, they saw a 2-m high wave. The wave carried their boat towards the shore. The passengers jumped from the boat and upon landing, experienced waist-level flood. Upon his return home I Guimaras Island which fronts Panay Island, his wife also told him about a wave observed in their island of Guimara after the earthquake. According to his wife, a “batel” named Flor Batel owned by Mr Juan Ilijan was also carried by the wave (Bautista et al, 2010). Meanwhile, newspaper accounts mentioned that two bodies were found afloat near Guimaras, believed to be fishermen whose boats captized during the earthquake (Manila Times, January 27, 1948)

4 DISCUSSION OF RESULTS

Going back to original documents to find out the extent of damaging intensities as a means to constrain the epicentral location raised more questions that provided answers. The earthquake's less serious effects in the epicentral towns of Anini-y and Dao already triggered the first question. Using the REDAS software, the estimated intensities were modeled and Figure 2 shows the expected distribution of intensity using original earthquake parameters. Comparing with the observed intensities, however, how come less severe intensities were observed in the epicentral area and were more severe in the inland towns of Panay Island especially Iloilo province? If we relocate the epicenter in the meioseismal area, would a submarine landslide be able to explain the occurrence of a tsunami? A corollary question is if indeed an offshore epicenter, was there ground rupture evidence that could be validated now? At the same time, how much impact did local site conditions coupled with level of construction have on level of damages? Meanwhile, an offshore epicentral to account for the tsunami should have caused similar structural damages in the island province of Guimaras, but none was encountered so far. Hence, pending the accumulation of more data, the current earthquake parameters for use in the scenario modeling were retained in this study.

5 SOCIO-CULTURAL IMPLICATIONS

The damaged structures during the 1948 earthquake were mostly the Spanish-era historical churches, symbols of the Spanish cultural influence in western Visayas. Most of these structures had been repaired and are still existing today. They remain strong pieces of evidence of the history and culture in western Visayan. At least one, the Miagao Church, has been declared a UNESCO-heritage site. Since a repeat of the Magnitude 8.2 earthquake could generate an Intensity VIII in most parts of west-central Visayas, such severe intensity threatens the integrity of these historical and irreplaceable ecclesiastical structures. At the same time, the combined population of the provinces of Antique, Iloilo, Aklan and Capiz and Guimaras is now more than six million inhabitants while Iloilo City alone has a population of more than 400,000 inhabitants. Based on the computed ground shaking estimates, more than 300,000 inhabitants would be exposed to Intensity VIII. Another way to look at the socio-economic impacts would be to estimate the economic loss. The economic value of losses circa 1948 were cited in the newspaper reports and probably could be used as a benchmark to compute current economic values. This method is being studied at present. Meanwhile, it has been more than 60 years since the lady Caycay event and development has been happening leaps and bounds in this part of the Philippines. To prevent or minimize economic setback in this part of the country from a Lady Caycay scenario, the results need to be shared with local governments to convince them about the need to

strictly adhere strictly to building codes, conduct intensive public education campaigns and use results as inputs to landuse plans.

6 FUTURE STUDIES

The research opened more questions than answers because the study team realized that there are still many potential sources of information that can be gathered and pieced together to understand the source parameters of the Lady Caycay earthquake. These are other archival documents in Capiz, Aklan and in the island provinces of Negros. There are also a need to really know what happened in Negros Island especially the extent of damaging intensities and tsunami. It is only when all of these information are pieced together that relocation of epicenter and re-estimation of magnitude can be confidently done. Further search is being planned to be continued in other Panay island provinces such as Aklan and Capiz and in the neighboring island of Negros. The research is a race against time especially if we want to collect information from tsunami eyewitnesses. As it is, we should be looking for people 75 years old and above, were in vantage position when the earthquake and tsunami occurred and still have clear memory. Another possible method to find out the parameters would be to study global seismic records, if available.

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6 FIGURES



Figure 1. The photo on the upper right is the 16th-century San Joaquin Church showing effects of the 1948 Lady Caycay Earthquake where the belfry collapsed. The photo on the bottom is the current-day San Joaquin Church after the belfry has been repaired.

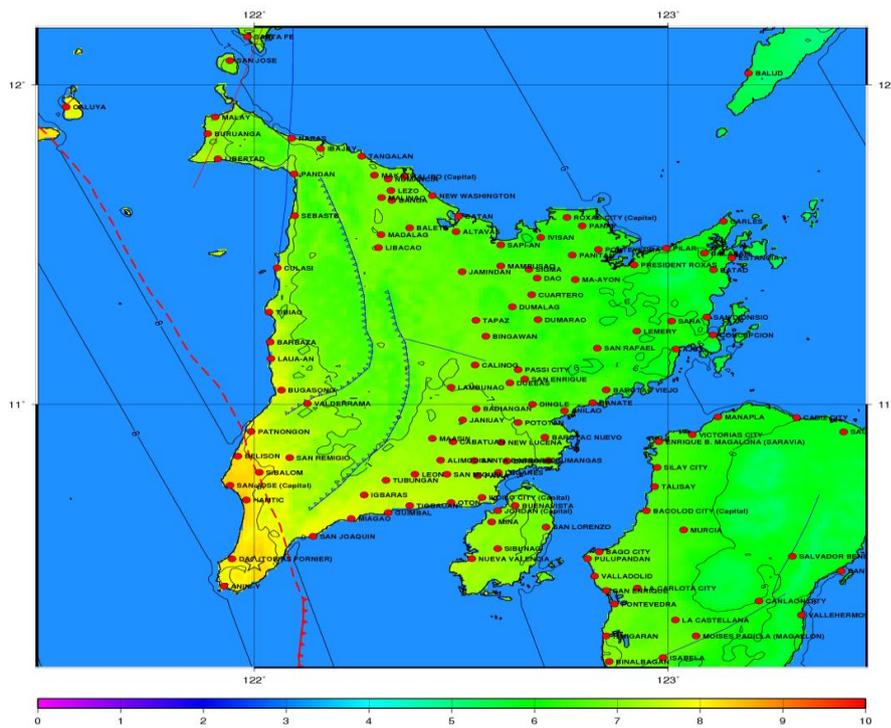


Figure 2. Ground shaking modeling results of the 1948 January 25, 1948 Lady Caycay Earthquake. Yellow star in the SW area of Panay Island (the biggest island in the figure) shows the location of the epicenter as determined by Gutenberg and Richter. Intensities, in PHIVOLCS Earthquake Intensity Scale of I to X, are colored coded and delineated as isoseismal lines. Using this current earthquake parameter would fail to explain the intensity distribution.