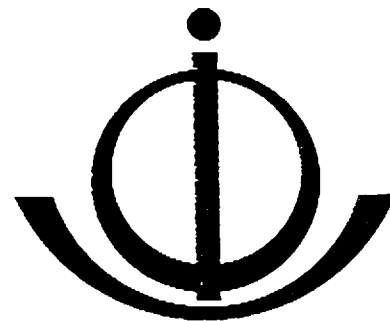




TSUNAMI REPORTS

No 1976-26



INTERNATIONAL OCEANOGRAPHIC COMMISSION
COMMISSION INTERNATIONALE D'OCÉANOGRAPHIE
COMISSÃO INTERGOVERNAMENTAL DO OCEANO
COMMISSION INTERNATIONALE D'OCÉANOGRAPHIE

Prepared and published by the
International Tsunami Information Center
P.O. Box 3830, Honolulu, Hawaii 96812

SUMMARY OF EVENT Large tsunami generated but confined largely to Moro Gulf, Philippines. Thousands of lives were lost.

EARTHQUAKE DATA

ORIGIN DATE (UT): August 16, 1976

TIME (UT): 1611

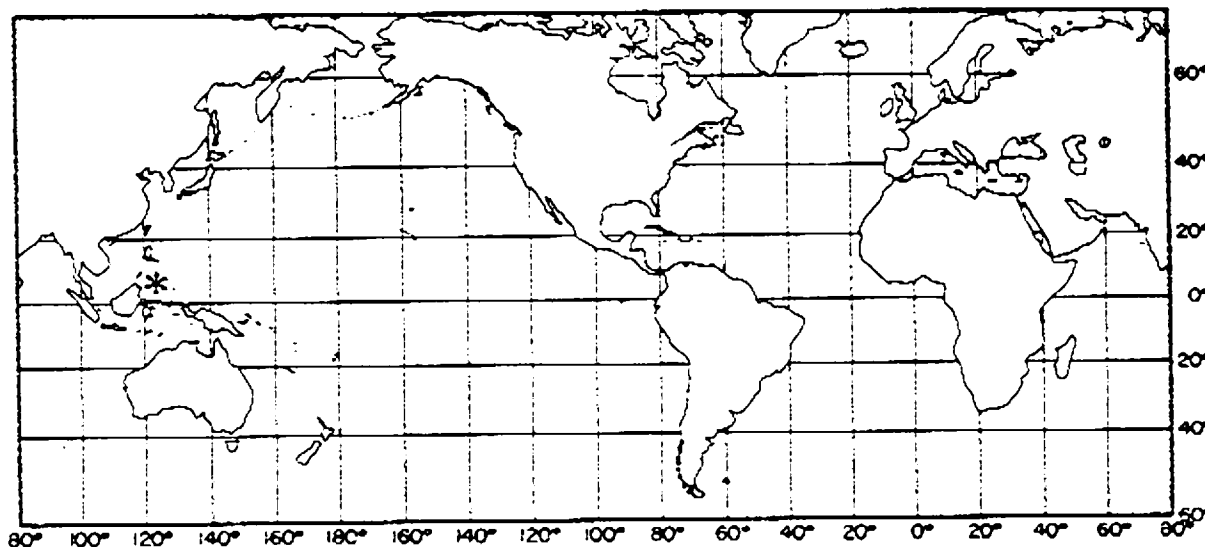
POSITION: Latitude: 06.3 N

Longitude: 123.7 E

REGION: Moro Gulf, Philippines

MAGNITUDE: 8.0

FOCAL DEPTH (KM): Shallow



DATE OF ISSUE APRIL 1978

*EARTHQUAKE EPICENTER

TSUNAMI REPORTS No 1976-26

"Another common observation was a loud roaring that preceded the arrival of the waves, a loud sound that kept getting closer. People living by the sea are familiar with the different sounds of the sea and can distinguish between them. Several independently had the same reaction at different places. On hearing what seemed like cascading rain, they looked up and wondered why the sky was clear. It was an unusual sound. And a loud one too. At San Jose, one kilometer inland from Pagadian, the sounds of the sea are not heard, but this roar was distinctly heard. In short, the sound was strange, strong and frightening. While it is clear that the sound was coming from the incoming waves it is not clear what specifically was causing the sound."

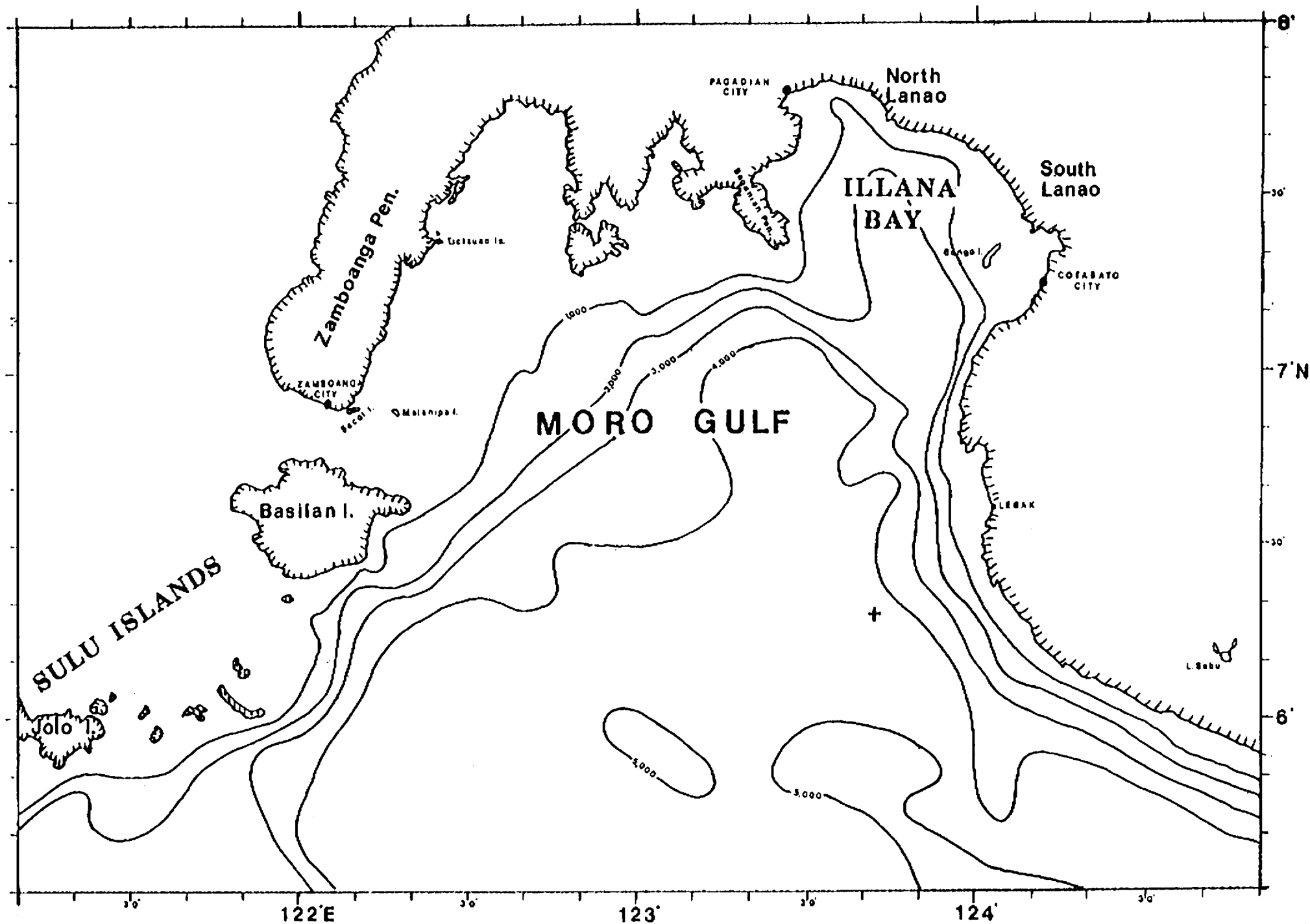
"At Lebak the water level just kept rising - like a tide. At Sacol Island and at Bongo Island, it was a wall of water advancing - like a bore. At Pagadian, a tilted wall of water straightened up and crashed down - like a breaker. The variety of bottom topography would explain the variety of appearances. Whatever the appearance, damage was caused."

"The sequence of events then was as follows. A shock violent enough to awaken coastal residents and make standing or walking difficult. A strong, prolonged, approaching sound different from familiar sea sounds, a frightening sound variedly described as cascading rain, rumbling of many trucks, etc. Arrival of waves within minutes, preceded by an unusually deep recession of the sea. Two or three waves following the first. Thus there were several distinct precursory indicators that could serve as natural warnings of a probable tsunami. They need not all be present in every tsunami. In fact, histories of other tsunamis make little mention of the strange sound preceding the waves."

TSUNAMI REPORTS No 1976-26

waves and many deaths from the tsunami were reported. On the island of Basilan, for example, 4.3 meter waves were reported, killing about 36 people. On the island of Jolo, the death toll was 89, with 107 missing. The survey of the eastern part of the Moro Gulf was extended as far north as Bolon and in the offshore islands of Sacol, Malanipa and Tictauan.

Based on the survey of the affected area, it was concluded that maximum waves in the entire Moro Gulf area were in the order of 4.5 meters, which was considerably less than was reported in the newspapers. Such large waves were experienced at Alicia, Pagadian City, Bongo Island, Resa Bay and Lebak. Based on the distribution of wave heights along the coastline of Moro Gulf, estimates of travel times of the tsunami to each point, and the directional failure of structures, both of the earthquake and the tsunami, lead to the conclusion that the earthquake and the tsunami generating area was in the upper part of the Moro Gulf, somewhat south of Baganian Peninsula and that the fault line was primarily under water in the Moro Gulf having an orientation from southeast to northwest. This conclusion is supported by ground deformations and building failures at both Tabina and Cotabato City and earthquake intensities that were observed. Surprisingly, the earthquake, although of great magnitude, produced little ground deformation on land areas. The majority of buildings failed because of poor construction or inadequate foundations. A number of buildings that failed were sitting on alluvial deposits with no pile support. Evidence of ground liquefaction was found in many areas where mud bubbles had reached the surface. Ninety percent of all deaths were the result of the tsunami. Hardest hit were Moslem Communities where a number of residences are either close to the coastline or on stilts in the water.



TSUNAMI REPORTS No 1976-26

PHILIPPINE EARTHQUAKE AND TSUNAMI OF AUGUST 17, 1976

by

George Pararas-Carayannis and Sydney O. Wigen

International Tsunami Information Center

P.O. Box 3830

Honolulu, Hawaii 96812

On August 17, 1976, a devastating earthquake of approximate magnitude 8 hit the island of Mindanao in the Southern Philippine Islands. The epicenter of this earthquake was in the Gulf of Moro in the Celebes Sea. A large tsunami generated by the earthquake resulted in the death of thousands of people in coastal communities in the Sulu Islands, North and South Zamboanga, North and South Lanao, North Cotabato, Maguindanao, and Sultan Kudarat, on the island of Mindanao. In response to this tsunami disaster, and in accordance with the role of ITIC in obtaining information and documentation of major catastrophic tsunamis, the ITIC staff proceeded to the Philippine Islands to conduct a tsunami survey. The survey team was joined by Dr. Rolando Valenzuela of PAGASA and by Dr. Robert Wallace of the U.S. Geological Survey.

Pagadian City was the major city in the area that was struck by both the earthquake and tsunami and reported the greatest number of casualties. A survey of Pagadian City and of the vicinity was undertaken. This survey included measurements of the horizontal and vertical extent of inundation, observations on the failure of structures and buildings, collection of information on the seismic affects, interviews of eyewitnesses and officials, and observations on the response of the people to the disaster. Statistical information was gathered on loss of life and property.

In addition to ground measurements, an aerial photographic survey of the tsunami runup areas was undertaken, flying at low altitude along the coast. Some of the areas that were hardest hit by the earthquake and tsunami were either visited or surveyed from the air. These included the villages of Margosatubig, Malangas, Alicia, Tabina, San Pablo, Labangan and Tukuran. In the following days, the survey was extended along the north and eastern part of the Llana Bay, including the area of Karomatan, Malabang, and Cotabato City, Bongo Island, Linek, Kinimi, Resa Bay, Port Lebak. Port Lebak was the southernmost point along the eastern part of the Moro Gulf that was visited. No casualties were reported from the state of South Cotabato, other than a seiche in Lake Sebu, an inland lake, which according to reports destroyed 200 homes. Since no death reports were given for this part of southern Mindanao, it was assumed that the waves in this area were insignificant.

Following the investigation of the eastern part of Moro Gulf, the survey party returned to Zamboanga City to begin inspection of the western side of the Gulf of Moro. The survey along the eastern portion of the islands of Basilan and Jolo in the Sulu Island Group was somewhat hampered by logistical problems. Both these islands experienced large

TSUNAMI REPORTS No 1976-26

A comprehensive account of this event is given in: Badillo, Victor L. and Astilla, Tinnia C. 1978: Moro Gulf Tsunami of 17 August 1976. Report prepared for Special Committee on Tsunami Warning System, National Committee on Marine Sciences, National Development Board, Philippines.
35 pp

Extracts from above report:

"A few minutes after midnight on 17 August 1976, a violent earthquake originating beneath Moro Gulf spawned a tsunami that affected 700 km of coastline bordering Moro Gulf. Residents in those areas experienced what seemed to be the longest thirty minutes of their lives.

When the sea had spent its fury and rolled back to its normal cadence, the survivors looked upon scenes of death and destruction. About 8,000 were dead or missing. About 10,000 were injured and about 90,000 were homeless."

"The earthquake responsible for the tsunami occurred a few minutes after midnight (120° East local time) beneath Moro Gulf, 40 km off the shores of Sultan Kudarat province."

"Almost universally, no one made the connection between the severe earthquake and probable tsunami. They just stayed where they were. Tragically some ran to the shores."

"As the waves approached the shore, the wave heights increased. Measured and estimated values of wave heights by PAGASA/ITIC never exceeded 4.3 meters. As expected these values are less than those given by survivors, considering their state of mind at the time. Estimates of wave heights had to be based on qualitative descriptions of the waves being as tall as a coconut tree, a two storey house, twice a man's height, etc., or had to be deduced from photographs of damaged structures. Places where waves were reported to be higher than five meters are: Linek (Maguindanao), Kalanganan (Cotabato City), Pagadian City, Sacol Island (Zamboanga City), and Lebak (Sultan Kudarat). At Lebak waves may have been as high as nine meters."

"That there were three or four waves were indicated by the majority of respondents. The largest number was seven, reported by one person. One thing is definite - there was more than one wave. Majority of respondents estimated the interval between waves to be between one to five minutes. As many considered the first wave to be the most destructive as considered it was the third. At the time of the earthquake the last quarter moon was some 30 degrees above the eastern horizon, so that there was enough light to see."

"A common observation at widely scattered places was a deep recession of the water before the arrival of the first wave Some persons ran out to the newly exposed sea bottom out of curiosity or to pick up stranded fish."