

# Submarine Earthquakes, Part II

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<sup>1</sup> As you read in the article, *Submarine Earthquakes, Part I*, underwater earthquakes can cause **tsunamis** (pronounced *soo-nahm-ee*). The word "tsunami" comes from the Japanese language, and it means "harbor wave." People tend to call tsunamis "tidal waves"; however, these waves really are not formed because of tides. In this article we will explore the characteristics of tsunamis and the destruction they cause.

<sup>2</sup> Tsunamis are a series of catastrophic ocean waves that are formed after submarine earthquakes, volcanic eruptions, landslides, or asteroids striking the earth. Asteroids may not be a normal occurrence; however, earthquakes, volcanic eruptions, and landslides under the ocean happen more frequently than you realize. This is why seismologists at Tsunami Warning Centers in Honolulu, Hawaii, and Palmer, Alaska, constantly monitor or keep track of underwater disturbances in the Pacific Ocean (the area where tsunamis occur most often) and surrounding areas.

<sup>3</sup> Tsunamis occur most often after submarine earthquakes that measure over a 6.5 magnitude on the Richter scale. Underwater volcanic eruptions in the mid-ocean mountains and ridges and landslides in the continental margin can cause submarine earthquakes. Once the earthquake occurs and the ocean floor is disturbed, waves travel outward in all directions from the focus of the earthquake. Imagine throwing a rock into a lake on a summer day. When the rock breaks the surface of the water, ripples appear and radiate outward from the point where the rock entered the water. The waves then travel through the open sea. In the open ocean, these waves may reach a speed up to 500 miles per hour (720 kilometers per hour). Their wavelengths may also be up to several hundred miles. One surprising fact is that their heights at this point may only reach less than three feet (one meter). Even a ship at sea would not notice this tsunami wave.

<sup>4</sup> Once the tsunami waves travel closer to the shallow water near coastlines, they change dramatically and turn into destructive forces. The wave slows down which causes its length to shorten. As a result, the wave's height increases, sometimes up to 100 feet (30 meters). Once these waves hit the shore or break, they can destroy buildings, piers, beaches, and most importantly, cause the death of humans and animals. The height of a tsunami wave will depend on the way the shoreline is formed. If the shoreline is gently sloping or has underwater ridges, then the wave tends to be very high.

<sup>5</sup> Unfortunately, there is very little warning when a tsunami is approaching. As the waves approach the coastline, they appear as normal storm swells. Then they dramatically change into sudden bursts of water. The first huge wave, which strikes within minutes after this burst, floods the exposed beach and inland areas. Tsunami waves that approach the coast after the first wave are the largest.

<sup>6</sup> Even though seismologists frequently monitor tsunami activity using wave gauges, these waves can approach the coastline within minutes to a few hours after a submarine earthquake. They may also use satellites to measure sudden changes in the sea level. Once the seismologists detect a tsunami, they try to send out a warning to all areas in the tsunami's path. Unfortunately, if the affected areas are in remote places of the earth, this warning may not reach their citizens in time.

<sup>7</sup> Just as some areas of the world are more prone to earthquakes, there are also areas that are prone to tsunamis. The state of Hawaii has the greatest risk of a tsunami. They have at least one a year and a very damaging tsunami about every seven years. Alaska, California, Oregon, and Washington state may experience a destructive tsunami about every eighteen years. Geologists, oceanographers, and seismologists continue to study underwater earthquakes, tsunamis, and other disturbances. As they gain more information, they continue to work to improve and expand the world's tsunami warning systems.

<sup>8</sup> *Author Note: On December 26, 2004 the most destructive tsunami in history occurred when an 9.0 magnitude submarine earthquake happened in the Indian Ocean off the Indonesian island of Sumatra. The earthquake produced waves that were as high as 30 feet (10 meters). These waves crashed into the coastlines of Indonesia, Sri Lanka, India, and Thailand. It caused damage to boats and flooded areas on the eastern coast of Africa which is about 3,800 miles away. To date, thousands of people have perished and many still remain missing.*

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<p>1. In _____ tsunami means "harbor wave."</p> <p><input type="radio"/> A French</p> <p><input type="radio"/> B Portuguese</p> <p><input type="radio"/> C Japanese</p> <p><input type="radio"/> D Swahili</p>	<p>2. Ocean tides do not cause tsunamis.</p> <p><input type="radio"/> A False</p> <p><input type="radio"/> B True</p>
<p>3. Seismologists may use _____ to monitor tsunami activity.</p> <p><input type="radio"/> A Wave gauges and satellites</p> <p><input type="radio"/> B Wave gauges and ocean liners</p> <p><input type="radio"/> C Satellites and cables</p> <p><input type="radio"/> D None of the answers below</p>	<p>4. What are the characteristics of a tsunami wave as it travels in the open ocean?</p> <p>_____</p> <p>_____</p>
<p>5. Submarine earthquakes in the Cascadia Subduction Zone have been measured at a magnitude of 8 or above on the Richter scale.</p> <p><input type="radio"/> A False</p> <p><input type="radio"/> B True</p>	<p>6. Tsunamis occur most often after submarine earthquakes that measure _____ on the Richter scale.</p> <p><input type="radio"/> A Less than 3</p> <p><input type="radio"/> B Greater than 6</p> <p><input type="radio"/> C Greater than 5</p> <p><input type="radio"/> D Less than 5</p>
<p>7. What are the characteristics of a tsunami wave once it reaches a coastline?</p> <p>_____</p> <p>_____</p>	<p>8. Why is it difficult to warn people about tsunamis?</p> <p>_____</p> <p>_____</p> <p>_____</p>

