AWESOME stories

EPILOGUE - EARTHQUAKE in JAPAN

Tsunami coming ashore and causing destruction at Sendai Airport on March 11, 2011. Photo by Japanese Coast Guard.

After World War II ended, and the occupation of Japan was over, people rebuilt their lives. The Japanese always remained exposed, however, to one constant danger. Their country's position, on "The Ring of Fire," makes them vulnerable to earthquakes (and the potential of resulting tsunamis). In 1923, for example, the "Great Kanto Earthquake" devastated both Tokyo and Yokohama, killing about 130,000 people.

Japan is prone to major earthquakes because it is located near the boundary of the Pacific and North American tectonic plates. Movement of those plates can cause the earth to shake - sometimes violently.

Why does this happen? The process (this helpful animation is from the BBC) has everything to do with how the earth is constructed. Tectonic plates can “grind” against each other. Those movements can dislocate segments of the Earth’s crust (which is one cause of earthquakes):

> *An earthquake is the vibration, sometimes violent, of the Earth's surface that follows a release of energy in the Earth's crust. This energy can be generated by a sudden dislocation of segments of the crust, by a volcanic eruption, or event by manmade explosions. Most destructive quakes, however, are caused by dislocations of the crust.*
>
> *The crust may first bend and then, when the stress exceeds the strength of the rocks, break and "snap" to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake along the surface and through the Earth at varying speeds depending on the material through which they move. Some of the vibrations are of high enough frequency to be audible, while others are of very low frequency. These vibrations cause the entire planet to quiver or ring like a bell or tuning fork.* (USGS, "How Earthquakes Happen.")

Thrust faulting, on or near a subduction zone (where the plates come together), can cause one side to move up - then over - adjacent ground. Scientist believe such an event caused Japan's massive 8.9 earthquake on March 11, 2011.

Beyond the horrors of the quake itself - which occurred at 2:46 in the afternoon (local time) - aftershocks typically follow. The combination of events can make it seem as though people are on a wave-tossed ship. Engineering techniques, however, continue to save many Japanese skyscrapers from destruction - causing them to sway instead of fall.

Misery is compounded when the quake is a subduction event because a tsunami (this is another BBC animation) could follow. Often more deadly than a quake, tsunamis are rushing walls of water which slam into whatever is in the way.

Buildings - vulnerable as match sticks - can be swept from their foundations and washed away by huge, fast-moving waves which travel to far-distant places. (The March 11th tsunami reached the harbor of Santa Cruz, California.) People are in the same predicament - unless they have been warned to seek higher ground. Ships, suddenly caught in monstrous waves, have trouble staying aright.

While Japan has not been war-torn in recent years, its people have been battered by earthquakes. The 8.9 event, of March 11th, is believed be the worst in the country's history.

Occurring off the east shore of Honshu (one of Japan's home islands), the epicenter was 80 miles (130 km) east of Sendai (a city of 1 million people) located in Miyagi Prefecture. When the wall of water followed, it inundated Sendai's airport, crippled the entire area and flattened some of the towns.

Japan relies on nuclear power to supply its energy needs. (Follow the link to learn how that process works.) The quake's epicenter was 110 miles (178 km) east-northeast of the Fukushima Nuclear Plant, in Onahama city. That plant, like all others in the country, has emergency shut-down procedures in the event of an emergency (such as an earthquake).

Sometimes, however, emergency procedures - including redundant protections - do not work as planned. Fukushima's #1 plant developed issues when the earthquake and/or tsunami cut power to the plant and back-up generators also failed. Then, on the 12th of March, the facility sustained an explosion.

Thereafter, another explosion occurred, at Fukushima's reactor #3. Failures continued as cooling rods in reactor #2 were almost fully exposed. When cooling rods are exposed, temperatures rise and the threat of a meltdown increases. (Scroll down 40% for a video explanation of nuclear meltdowns.) The timeline of events, at Japan's nuclear facilities, reveals the serious nature of this problem.

To prevent radiation escaping from the reactor's core and harming people - bringing to mind the Chernobyl disaster of 1986 when the meltdown of an improperly designed reactor occurred - workers at the Fukushima plant used several alternative methods to mechanically restore the water supply to the reactor's cooling system. It remains an open issue whether their efforts - and those of helicopters dropping water into the stricken reactors - will be successful.

Concerns about a meltdown persist - follow the link to an animated explanation - while an exclusion zone surrounds the Fukushima plant site. Heroic workers, disregarding their own safety for the good of others, are known as the "Fukushima 50."

To calm the nerves of his people, Emperor Akihito made a rare appearance on live television during the nuclear crisis. Deeply respected in Japan, the Emperor offered hope and encouragement to a troubled nation.

As people around the world watched the unfolding disaster, "flags of our fathers" became "flags of us all" as offers to help the Japanese people poured into the country. Despite incredible hardships facing evacuees - in addition to seemingly endless and numbing losses - a few moments of joy surfaced amidst the personal and economic heartbreak.

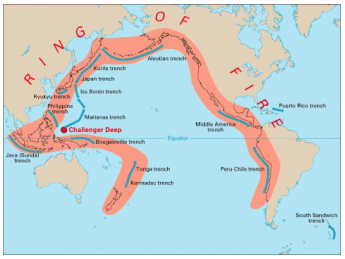
On the 13th of March, a sixty-year-old man (Hiromitsu Shinkawa) was rescued - nearly ten miles at sea - clinging to the roof of his home. He had drifted for two days.

See Alignments to State and Common Core standards for this story online at:
http://www.awesomestories.com/asset/AcademicAlignment/EPILOGUE-EARTHQUAKE-in-JAPAN-Flags-Of-Our-Fathers

See Learning Tasks for this story online at:

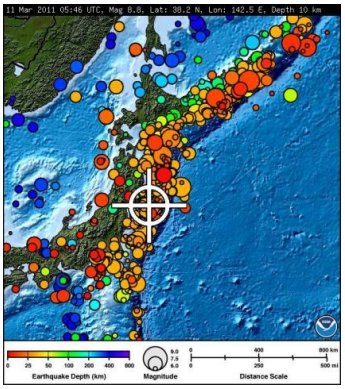
http://www.awesomestories.com/asset/AcademicActivities/EPILOGUE-EARTHQUAKE-in-JAPAN-Flags-Of-Our-Fathers

Media Stream



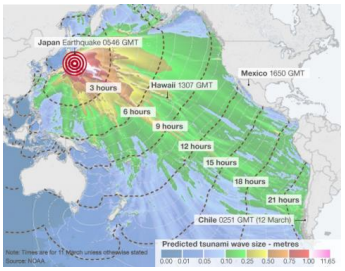
Ring of Fire - Propensity for Earthquakes

Graphic of "The Ring of Fire," by USGS, from "This Dynamic Earth: The Story of Plate Tectonics."
Image online, courtesy USGS.
View this asset at:
http://www.awesomestories.com/asset/view/Ring-of-Fire-Propensity-for-Earthquakes



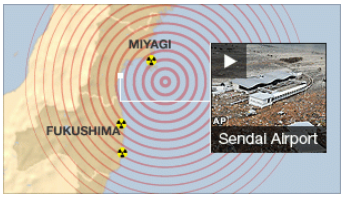
Moment of March 11 Quake - 2:46 Local Time

Graphic by NOAA; online, courtesy NOAA.
View this asset at:
http://www.awesomestories.com/asset/view/Moment-of-March-11-Quake-2-46-Local-Time



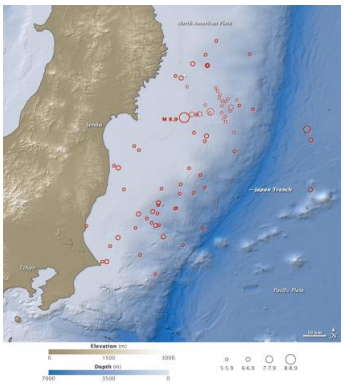
Tsunami Wave Predictions - March 11, 2011

Graphic by NOAA (National Oceanic Atmospheric Administration). Image online, courtesy NOAA.
View this asset at:
http://www.awesomestories.com/asset/view/Tsunami-Wave-Predictions-March-11-2011



Epicenter - March 11, 2011 Quake

Epicenter image, online courtesy USGS.
View this asset at: http://www.awesomestories.com/asset/view/Epicenter-March-11-2011-Quake



Location of March 11 Earthquake - NASA

Image online, courtesy NASA.
View this asset at:
http://www.awesomestories.com/asset/view/Location-of-March-11-Earthquake-NASA

Miyagi Prefecture - Hard Hit by Earthquake and Tsunami

Graphic, depicting the location of Miyagi Prefecture, by LERK. Online, courtesy Wikimedia Commons.

View this asset at:
http://www.awesomestories.com/asset/view/Miyagi-Prefecture-Hard-Hit-by-Earthquake-and-Tsunami

Great Kanto Earthquake - 1923

Archival footage, from 1923, of the Great Kanto Earthquake. Online, courtesy Japanese national archives.

View this asset at: http://www.awesomestories.com/asset/view/Great-Kanto-Earthquake-1923

March 11 Earthquake - Eyewitness Account

Video clip - from March 11, 2011 - from Russia Today. Online, courtesy Russia Today's channel at YouTube.

View this asset at:
http://www.awesomestories.com/asset/view/March-11-Earthquake-Eyewitness-Account

Japan's Earthquake - Chaos in a Grocery Store

Video of Japanese grocery store online, courtesy YouTube.

View this asset at:
http://www.awesomestories.com/asset/view/Japan-s-Earthquake-Chaos-in-a-Grocery-Store

Tsunami at Sendai Airport - Product of 8.9 Earthquake

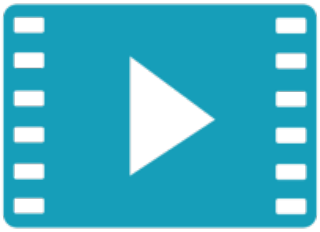
Video clip of CCTV camera, at Sendai airport - March 11, 2011 - online, courtesy Japanese television.

View this asset at:
http://www.awesomestories.com/asset/view/Tsunami-at-Sendai-Airport-Product-of-8.9-Earthquake

Tsunami - Seeking Rooftop Shelter in Sendai

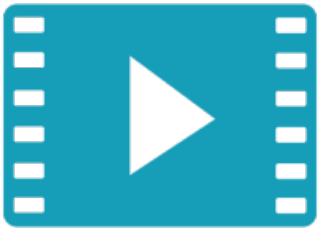
Video from Fuji TV, online courtesy Russia Today's channel at YouTube.

View this asset at:
http://www.awesomestories.com/asset/view/Tsunami-Seeking-Rooftop-Shelter-in-Sendai



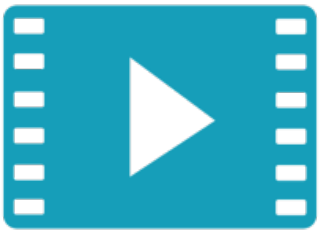
Tsunami in Japan - Devastation from 8.9 Earthquake

Video clip, depicting the impact of Japan's 8.9 earthquake, online courtesy Russia Today.
View this asset at:
http://www.awesomestories.com/asset/view/Tsunami-in-Japan-Devastation-from-8.9-Earthquake



Tsunami Warnings Following 8.9 Earthquake in Japan

Video clip, warning where tsunami waves could travel - and their potential height - online, courtesy Russia Today (via its YouTube channel).
View this asset at:
http://www.awesomestories.com/asset/view/Tsunami-Warnings-Following-8.9-Earthquake-in-Japan



Impact of March 11 Tsunami - Santa Cruz Harbor

Video of Santa Cruz harbor - March 11, 2011 - online, courtesy CCPhotograph's Channel at YouTube.
View this asset at:
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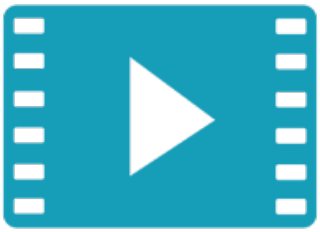
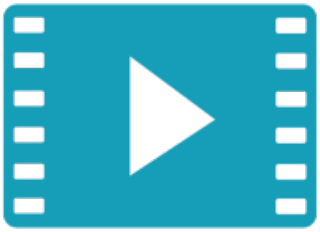


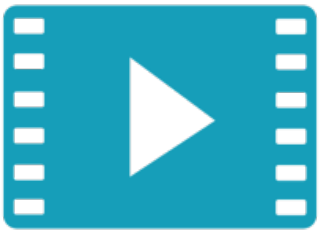
Swaying Tokyo Skyscrapers - Shinjuku District

Video clip online, courtesy YouTube.
View this asset at:
http://www.awesomestories.com/asset/view/Swaying-Tokyo-Skyscrapers-Shinjuku-District



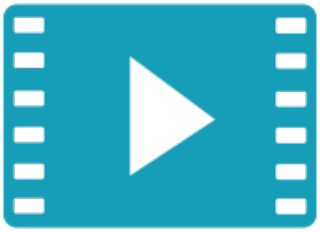
Impact of Tsunami on Ships

Video of scenes in Japan, following the March 11th tsunami, online courtesy Russia Today.
View this asset at: http://www.awesomestories.com/asset/view/Impact-of-Tsunami-on-Ships



Fukushima Nuclear Plant - Explosion

Video clip of an explosion taking place at the Fukushima Nuclear Plant - on March 12, 2011 - online, courtesy Japanese national television.
View this asset at: http://www.awesomestories.com/asset/view/Fukushima-Nuclear-Plant-Explosion



Tsunami - Searching for Survivors in Flattened Towns

Video clip of search-and-rescue operations - recorded by Japanese journalists from Kyodo News on Monday, March 14, 2011 - online, courtesy Russia Today's channel at YouTube.

View this asset at:
http://www.awesomestories.com/asset/view/Tsunami-Searching-for-Survivors-in-Flattened-Towns