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Consultant's Corner

West Coast vs. East Coast Earthquakes

When an earthquake struck near Richmond, Virginia in the middle of the afternoon on August 23, 2011, the initial reaction of some East Coast residents was to attribute the shaking ground to a terrorist attack rather than to a natural phenomenon. While a 5.8 magnitude earthquake would hardly have raised eyebrows in California, for many along the eastern seaboard it was the first time they had ever actually felt an earthquake. Large earthquakes are rare in the eastern United States due to geologic conditions that differ in many ways from those found in the western United States.

The most significant difference is that much of the West Coast, most notably California, lies above the boundaries of two of the major tectonic plates (the North American and Pacific plates) that make up the earth's crust. The earth's crust, or lithosphere, is made up of at least 15 separate tectonic plates that float above a viscous layer of hot, molten material known as the asthenosphere (the uppermost layer of the mantle). Earthquakes and volcanic activity occur most frequently along plate boundaries; this is why earthquakes are common occurrences in certain parts of the world, such as California, Chile, and Japan, to name just a few. More than 90 percent of the world's earthquakes occur in an area known as the "Pacific Ring of Fire," a horseshoe-shaped zone of convergent plate boundaries that encompasses about 25,000 miles of nearly continuous oceanic trenches, volcanic island arcs, and volcanic mountain ranges. In contrast, the East Coast of the United States lies in the middle of the North American tectonic plate which stretches eastward from California to the middle of the Atlantic Ocean.

Contractors from WJE conducting exterior assessment of the Washington Monument on September 28, 2011. Over 555 feet tall, the free-standing masonry structure sustained damage such as cracks and displaced stone.

East Coast's Crust is "Older, Colder, and Harder"

When earthquakes do occur in the middle of tectonic plates, they typically occur as a result of compressional forces that build up over a long period of time. While this tends to produce lower magnitude earthquakes, the earthquakes generated tend to be felt over a much wider area. An earthquake east of the Rockies is typically felt over an area ten times larger than a similar-sized earthquake on the West Coast; the Virginia earthquake was felt from Toronto, Canada all the way to Georgia. This is due to the characteristics of the earth's crust in the East, which is described by seismologist Lucy Jones of the United States Geologic Survey (USGS) as "older, colder, and harder." Seismic waves travel more efficiently through the East's cold, brittle crust than they do through the higher temperature,

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Antarctica and West Texas Share Common Ground

An international team of researchers recently discovered evidence that volcanic rocks found in both Antarctica and in mountains near El Paso, Texas were once part of the same supercontinent (a single continent consisting of all Earth's landmass) known as Rodinia that existed over a billion years ago. It is postulated that, through the movement of the plates that form the earth's crust, the earth has undergone several cycles of the formation and breaking up of supercontinents over its 4.6 billion-year history. Vaalbara formed about 3.1 billion years ago, followed by Kenorland, Columbia, Rodinia, Pannotia, and Pangaea, which existed some 250 million years ago and was the predecessor to the configuration of our modern continents.

The rocks recently collected and analyzed from Coats Land in East Antarctica and the Franklin Mountains of West Texas are exactly the same age and exhibit identical chemical composition, lead isotopes, and other geologic properties. This recent discovery supports the hypothesis that ancestral North America and East Antarctica were part of the configuration of Rodinia before it split into three pieces approximately 750 million years ago.

East vs. West Coast Earthquakes

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younger rock formations that characterize the West Coast. The longer-traveling seismic waves produce greater shaking and radiate more energy at higher frequencies, which tends to produce damage to smaller buildings and can affect the functioning of electronic instruments and devices. Another difference between East and West Coast quakes is the pervasive network of faults in the West Coast, which breaks up the earth's crust and forms barriers to transmittal of seismic waves.

Smaller Does Not Mean Less Dangerous

Lower magnitude earthquakes do not necessarily mean that they are less dangerous. Building codes applicable to more seismically active regions, such as California, require that the structural design of buildings take into account the potential for seismic movement; buildings are designed to withstand strong lateral shaking and may be flexible to allow dissipation of wave energy. In addition, materials commonly used in construction in seismically active areas tend to be those that fare better in an earthquake, i.e., wood, steel, or reinforced concrete or masonry, rather than unreinforced masonry. In the western United States, many cities have instituted programs that require that older buildings constructed of unreinforced masonry undergo retrofitting to render them safer during an earthquake. In the less seismically-active eastern states, building codes are less stringent with respect to seismic design or seismic upgrade considerations. There are also many older buildings constructed of brick, stone, or other materials that tend to be more vulnerable to seismically-induced damage. Finally, state and local emergency response plans may not be geared to the types of issues that are often associated with a large earthquake.

New Madrid Earthquakes of 1811-1812

The most powerful seismic event ever known to occur in the eastern United States was a series of earthquakes known as the New Madrid earthquakes of 1811 through 1812. On December 16, 1811, a pair of strong earthquakes struck the Mississippi Valley, which was then part of the Louisiana Territory. The epicenter was near New Madrid, located near the confluence of the Ohio and Mississippi Rivers. Additional earthquakes occurred on January 23, 1812 and February 7, 1812. The earthquakes were felt over a 1-million square mile area, and tremors were reported as far away as London. Although originally believed to have magnitudes of greater than 8.0, the earthquakes have since been downgraded to the range of 7.0 to 7.1.

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Leadership Transitions

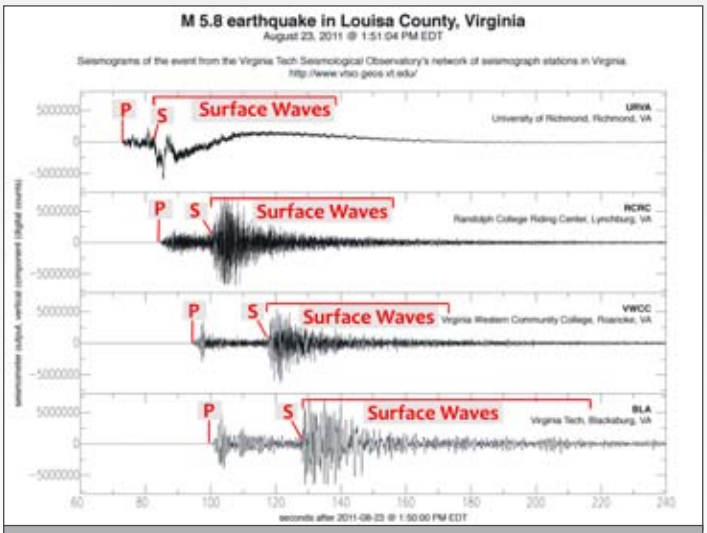
On September 9, 2011, Mr. Patrick Boales was promoted to the position of president and CEO of Earth Systems Southern California (ESSC). Of his new role, Mr. Boales says he is pleased to have the opportunity to lead the company forward. He describes himself as a "people person" and his new role affords him ample opportunity to be involved with clients and personnel as he oversees the management of ESSC's offices in Ventura, Van Nuys, Pasadena, and Palmdale.

Mr. Boales succeeds Mr. Richard Beard who was promoted to the position of chairman of the board of ESSC. Mr. Beard will continue in his role as chief geotechnical engineer at ESSC's Ventura office.

A certified engineering geologist and certified hydrogeologist, Mr. Boales will continue to conduct and manage geologic hazards studies, evaluating risks such as fault rupture and landslides and, where possible, mitigating such hazards so project development can proceed.

Thirty years ago, Mr. Boales began his career as a staff geologist, working on a drill rig for three years. At that time, he says, he never anticipated that he would one day become president of the company. "It's been quite a journey," he says, "with more journey yet to come." ▪

Mr. Patrick Boales, CEG, HG
President and CEO
of Earth Systems Southern California



Seismograms from recording stations at four different locations of the magnitude 5.8 earthquake in Virginia. Early primary (P) and secondary (S) wave arrivals are followed by the higher magnitude, more destructive surface waves.

After the February 7, 1812 earthquake, boatmen reported that the Mississippi River ran backward for several hours. It has since been speculated that uplifts of land and large waves generated by fissures opening and closing below the surface of the Mississippi River gave the illusion that the river was flowing upstream. River banks collapsed in many places and two temporary waterfalls were created along the river. Huge waves with heights of fifteen to twenty feet capsized many boats, and flooding reportedly drowned the inhabitants of an entire Indian village. The most lasting geographical effect was the formation of Reelfoot Lake, which developed in a fissure created by the earthquakes. The earthquakes created what is widely acknowledged as the world's largest sand boil, a feature that is 1.4 miles long that covers 136 acres. A sand boil is a combination of sand and water that flows onto the ground surface as a result of shallow liquefaction.

Other phenomena reported in historical accounts included lights flashing from the ground; this is known as "seismoluminescence" and is caused by the compression of quartz crystals. Golfball-sized "seismic tar balls," the result of petroleum that has rapidly solidified, were found in fissures and sand boils. People reported that the skies turned dark, that warm water spouted from the earthquake fissures, and that the earthquakes were accompanied by the sound of thunderous explosions.

Earthquake Foretold by a Prophecy?

Earthquake prediction is an imperfect science even in today's technologically-advanced world. Although much information is available regarding where earthquakes are likely to occur, seismologists generally agree that there is currently no reliable way to predict when an earthquake will strike a specific location. If historical accounts are to be taken at face value, however, there were portents warning of the New Madrid earthquakes for several months before the event. The "Great Comet of 1811" appeared in the sky in April 1811 and remained visible to the naked eye for over nine months. It was believed that comets were a bad omen, a warning of imminent disaster. One of the strangest stories involves a prophecy made by Tecumseh, a Native American leader who organized a confederation of tribes to oppose the takeover of 2 million acres of Native American lands in 1809. Tecumseh predicted that when he journeyed to Detroit, he would "stomp his feet and the earth would shudder." He arrived in Detroit on December 16, 1811, the very day the first of the New Madrid earthquakes struck the Mississippi Valley. ▪

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The Kitchen Sink

Striking Features of Fall

WITH OCTOBER COMES THE BASEBALL PLAYOFFS AND THE WORLD SERIES. Over a hundred years ago, the first official World Series was held in 1903. In a best of nine game series, the Boston Americans (American league) beat the Pittsburgh Pirates (National League) five games to three. The series took place at the Huntington Avenue Baseball Grounds in Boston and at Exposition Park in Pittsburgh.

AUTUMN ALSO MEANS THAT THE SANTA ANA WINDS ARE BLOWING ONCE AGAIN THROUGHOUT SOUTHERN CALIFORNIA. The warm dry winds blow from east to west reaching speeds of up to 45 mph. Named after the Santa Ana Canyon in southern California, the winds form in cold weather at high altitudes between the Sierra Nevada and Rocky Mountains. As the winds drain out of the mountains, the air is compressed and it heats up and dries out as it descends. There are many other winds around the world that have earned names such as the Williwaw and the Haboob. Even though according to the song "They Call the Wind Maria" (pronounced with a long "i" sound), Maria is not the name of a real wind at all. In his 1941 best-selling book *Storm*, George R. Stewart named his cyclone "Maria," and in 1951 Lerner and Lowe used the name as inspiration for their song in the musical *Paint Your Wagon*. Since the late 1800s, storms have been named after women. In 1978, men's names were included. The World Meteorological Organization currently controls the system of naming storms. ▪

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Pumice

Often light enough to float in water, pumice is a rock formed from a gas-rich magma. The gas expands as the magma rises in the vent of a volcano. This forces the magma out explosively and it becomes a froth of gas and magma that cools rapidly in the air. As it solidifies, the magma turns to glass trapping some of the gas bubbles and lumps of pumice are formed. Depending on the composition of the magma, pumice will be formed in different colors such as white, yellow, brown, and black.

Versatile lightweight Pumice

The abrasive quality of pumice makes it an effective additive in erasers, cleaning and polishing compounds, and soaps and toothpastes. The rock itself is used in stone carving to smooth and polish the surface, and historically was used for smoothing leather to make parchment paper. Because of its porous quality, pumice provides excellent drainage when used as a growing substrate; greenhouse crops such as flowers, tomatoes, and peppers are grown successfully this way. Perhaps the most significant use of pumice is in the making of lightweight concrete. The Romans devised the method of adding pumice to concrete to lighten its weight, and this enabled them to produce innovations such as vaults, aqueducts, and even the dome of the Pantheon. Today, structural lightweight concrete is often used in the construction of bridge decks, parking structures, and tilt-up walls. ▪