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### Earthquake and Volcano Interaction

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Source: *Geology of the Book of Mormon* Published:

Vineyard, UT: n.p., 2014

Page(s): 137-138

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# Chapter 9

## Earthquake and Volcano Interaction

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Major tectonic earthquakes have long been linked to the triggering of volcanic eruptions, and evidence increasingly shows a mechanical relationship between these events (see Hill et al., 2002, and references therein). Scientific descriptions of volcanic eruptions concurrent with large earthquakes date back at least to the 19th (Darwin, 1840) and early 20th centuries (Rockstroh, 1903). The volcanoes Cordón Caulle and Puyehue erupted in Chile just one day after the large 1960 Valdivia earthquake (Barrientos, 1994; Lara et al., 2004).

Other prominent examples of volcanoes that have shown activity in association with major tectonic earthquakes are Mount Vesuvius and Mount Etna in Italy (Sharp et al., 1981; Necessian et al., 1991; Marzocchi et al., 1993; Nostro et al., 1998; Gresta et al., 2005), the Santa Maria volcano in Guatemala (Rockstroh, 1903; Williams and Self, 1983; White and Harlow, 1993), the New Hebrides (Blot, 1976), various volcanoes in Japan (Koyama, 2002), Alaska (Sanchez and McNutt, 2004), Kamchatka (Walter, 2007), Mount St. Helens in the US (Lipman and Mullineaux, 1981), volcanoes in Iceland (Gudmundsson and Andrew, 2007), and Kilauea and Mauna Loa in Hawaii (Swanson et al., 1976; Lipman et al., 1985; Walter and Amelung, 2006).

A worldwide detailed study of volcano and earthquake interactions was completed by Egger and Walter in 2009. They determined some patterns that apply to the 3<sup>rd</sup> Nephi situation:

1. Volcanic eruptions can be triggered within seconds of an earthquake event. Most volcanic activity occurs on the same day as the earthquake.
2. The highest correlation of earthquakes triggering volcanic eruption was around the Pacific Ring of Fire (volcanoes surrounding the Pacific Ocean).
3. The most common events occur when the earthquake is near the volcano.
4. Before an earthquake, there is less regional volcanic activity in the years leading up to the earthquake; after an earthquake, there is more regional volcanic activity.

Paralleling these findings, the 3<sup>rd</sup> Nephi eruption and earthquake occurred virtually simultaneously. The Isthmus of Tehuantepec is part of the Pacific Ring of Fire. The San Martín volcano in the Tuxtla volcanic complex lies directly in the Veracruz fault system and the magma preferentially follows the fault zone to the surface. El Chichón and other volcanoes in the Isthmus are also on fault zones or immediately adjacent to fault zones. Sorenson (2013, 641–49) noted the increase in volcanic activity in the first century AD, and there also appears to be a decrease in general activity leading up to the 3<sup>rd</sup> Nephi event (see chapter 7).

It is very clear that the 3<sup>rd</sup> Nephi description of a regional earthquake coupled with a volcanic eruption is a recognized geologic phenomenon.

