

Past volcanism in northern New Mexico—key to understanding potential future activity

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Volcanoes are abundant in New Mexico. The black, barren, lunar-landscape rocks around Grants and Carrizozo and the black flat-topped mesas around Albuquerque are volcanic lava flows. Mount Taylor is a volcano, Capulin Peak is a volcano, and Los Alamos is built on the flank of a huge volcano. Shiprock is the remnant of a volcano, as is Cabezon Peak. Although not as easy to recognize, many of the rocks in the Gila Mountains and other southern and western New Mexico mountain ranges are also volcanic. Volcanic rocks ranging from as young as 3,000 years old and up to ~1.7 billion years old are found in the state.

This panoramic stop atop Cochiti dam offers an opportunity to observe, from a distance, deposits from two of the most common types of volcanism in New Mexico. These two types of volcanism, not coincidentally, are the most likely to occur again. The large edifice of the Jemez Mountains that forms most of the topography from north to west, is a single large volcanic complex that began forming at least 16.5 million years ago. Much of this volcano was built by a large-volume and highly explosive, though infrequent, type of volcanic activity. The dark colored hummocky hills visible from the north to the east, and the sloping, shield-shaped skyline to the south are also volcanic. These deposits formed mainly between 2 and 3 million years ago, and are the result of the same type of volcanic activity that occurs in Hawaii today.

The pink to tan-colored flat-topped bluffs that stretch from north to west in the near distance are a volcanic deposit called the Bandelier Tuff. This tuff erupted during two, very large, volcanic eruptions that occurred 1.6 and 1.2 million years ago and is the same rock in which the Bandelier National Monument cliff dwellings are located. The darker colored, bare-looking outcrops between the Bandelier Tuff and the distant horizon are also volcanic rocks, but these were deposited in a series of smaller eruptions that occurred at least 5 million years earlier. The most distant skyline to the north and west is the Valle Grande area, which is the very large crater from which the Bandelier Tuff erupted.

Each of the two eruptions that formed the Bandelier Tuff was volumetrically more than 250 times larger than the 1980 Mount St. Helens eruption. No eruption this large has occurred anywhere in the world in historic time, and only six have occurred in the U.S. in the last 2 million years, including the two Bandelier Tuff eruptions, three from Yellowstone, and one from the Bishop area of California. The initial stages of the Bandelier eruption produced ash that rained out of the sky over most of New Mexico. Following the initial ash-fall part of the eruption, activity shifted to a pyroclastic-flow eruption. This stage produced a fast-moving, extremely hot, cloud of ash, pumice, and gas travelling as much as 30 km from the central vent that would have destroyed anything standing in its path, and then solidified into volcanic rock. This eruption style produces such hugely explosive events that even an eruption in an adjacent area, such as from the Yellowstone, could cause ash to fall in New Mexico. Ash from the most recent Bandelier Tuff eruption (1.2 million years ago) has been traced eastward into Oklahoma, Kansas, and Texas.

Although there have not been any major eruptions from the Jemez Mountains volcanic field for the last million years, there have been a number of smaller eruptions, the most recent of which occurred about 60,000 years ago. The Jemez Mountain volcanic field may be entering a new phase of volcanic activity, based on geophysical measurements and measured periodicities of eruptions. Wolff and Gardner (1995) recommend geo-

physical monitoring of the Jemez Mountain area, so that if an eruption were to occur, forewarning would be possible. At this point, there is no evidence of any unusual activity in the Jemez Mountains.

In contrast to the Jemez Mountains style of eruption, most of the recent volcanic activity in New Mexico has been of a more passive eruption style, producing lava flows and small cinder cones. Some examples of this type of activity include the 3,000 year old McCartys and the 10,000 year old Bandera Craters lava flows in the Zuni-Bandera volcanic field, near Grants, the 5,000 year old Malpais lava flows near Carrizozo, and the 55,000 year old Capulin peak. This type of eruption is generally known as Hawaiian, because it is the type of activity that formed, and continues to form, the Hawaiian Islands. These types of volcanic rocks are called basalts, and are typically black in color. The large, hummocky hills to the north and to the east and the shield-shaped skyline to the south, called the Cerros del Rio and Santa Ana Basalts, are also examples of this type of volcanism. Distinct lava flows can be seen as benches on the Cerros del Rio. Several distinct vents on the Santa Ana Basalts can be seen as slightly raised areas on the skyline. If there were to be a volcanic eruption in New Mexico in the next 100 or 1,000 years, it would most likely form either a lava flow, a cinder cone, or both. The eruptions that form these features do not involve major explosive activity, instead they involve lower levels of explosivity to form the cinder cones and slow-moving, although very hot, lava that flows downhill from the vent of the volcano. Depending on where it occurs, this type of eruption would be unlikely to cause major loss of life or property although the initial stages of the eruption could be dangerous to any nearby onlookers.

How likely is an eruption to actually occur in New Mexico in the near future? There have been more than 700 volcanic eruptions in New Mexico in the last 5 million years. The eruptive styles range from dangerously explosive to passive. Based on the past occurrence of volcanism, Limburg (1990) estimates that there is roughly a 1% chance that some type of volcanic eruption could occur somewhere in New Mexico in the next 100 years, and a 10% chance that an eruption will occur in the next 1,000 years. Widespread seismic monitoring and continued study around the state would help provide forewarning, and predict where an eruptive event might take place.

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