THE ST. GEORGE EARTHQUAKE OF SEPTEMBER 2, 1992

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A moderate earthquake that occurred near St. George, Utah, in early September caused considerable damage in southern Utah and was widely felt across northern Arizona, southern Utah, and southern Nevada. The magnitude 5.5 (University of Arizona) to 5.9 (University of Utah) earthquake occurred at 3:26 a.m. PDT on September 2, 1992, about 8 kilometers (5 miles) southeast of St. George (within a few miles of the Arizona border; see Figure 1). The earthquake did not cause any deaths or serious injuries; property damage due to ground shaking was relatively minor. A large landslide triggered by the earthquake, however, destroyed three homes and blocked a state highway in Springdale, Utah, near the southern entrance to Zion National Park (Figure 2). No earthquake-related damage was reported in Arizona, but the tremor was felt strongly in Fredonia, and individuals as far away as Flagstaff were awakened by the shaking (David Brumbaugh, oral and written commun., 1992). The St. George earthquake is particularly interesting to seismologists and geologists because it occurred in a region with several major active faults that have the potential to generate even larger earthquakes.

The Southern Arizona Seismic Observatory at the University of Arizona analyzed seismic waveforms recorded from the St. George earthquake to determine its characteristics. The earthquake originated at a depth of about 15 kilometers (9 miles). Slip during the earthquake was predominantly **normal** (vertical, with little horizontal displacement) and apparently occurred on a north-trending fault that dips about 50° to the west. The St. George earthquake is quite unusual because it has had virtually no aftershocks. The seismograph network operated by the University of Utah detected no aftershocks as large as magnitude 2 in the immediate area during the first 3 weeks after the St. George event.

The St. George earthquake is one of the largest historical earthquakes in northwestern Arizona and southwestern Utah. A magnitude 6 event occurred in November 1902, about 30 kilometers (19 miles) north of St. George. Both the magnitude and the location of this event are estimated from reported observations, not from seismic recordings. It is interesting to note that scientists would have placed the **epicenter** (the projection of the earthquake's point of origin onto Earth's surface) of the 1992 St. George earthquake in a similar location had they relied solely on damage reports. **Swarms** of earthquake activity (numerous earthquakes, none of which stands out as a distinct main event) have occurred several times in the Cedar City, Utah, area, including late June 1992 (Arabasz and others, 1992). In Arizona, several earthquakes with magnitudes of 6.0 to 6.2 occurred in the Flagstaff area in the early 1900's (David Brumbaugh, oral commun., 1992), and a magnitude 5.5 to 5.75 earthquake occurred near Fredonia in July 1959 (DuBois and others, 1982).

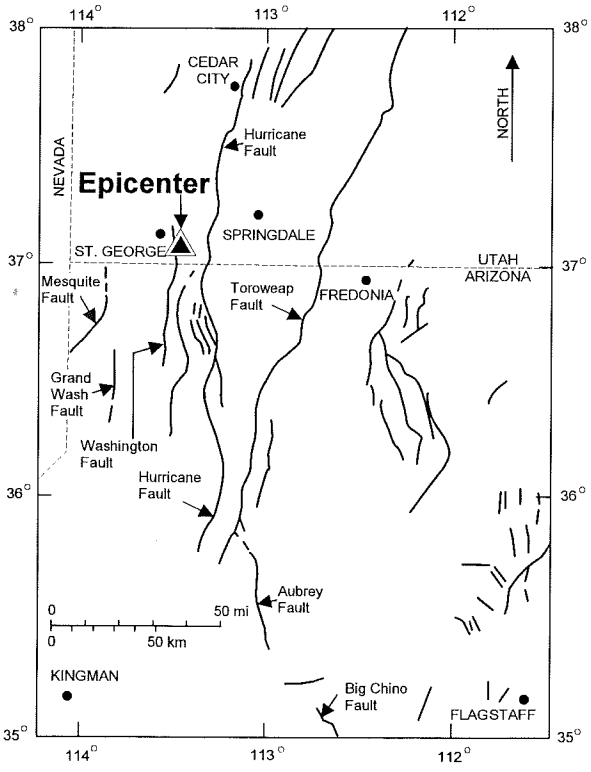
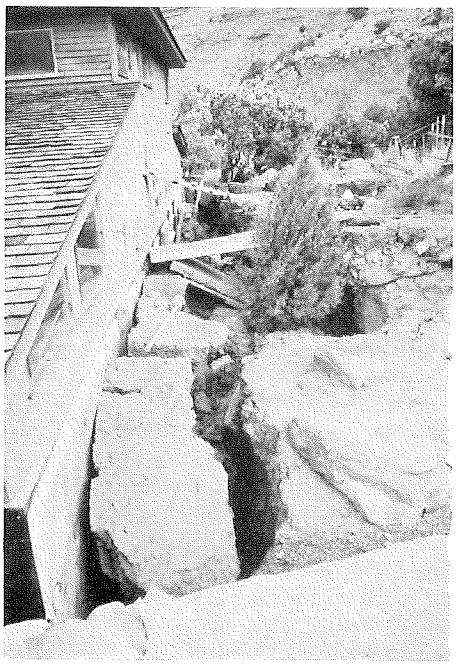


Figure 1. Locations of epicenter of 1992 St. George earthquake and late Quaternary faults in southwestern Utah and northwestern Arizona.

Figure 2. Ground cracks near a home damaged by the Balanced Rock landslide in Springdale, Utah, which was triggered by the St. George earthquake. The headwall scarp, which is about 20 meters (70 feet) high, is visible in the background. This scarp marks where the landslide broke away and shifted down from the rest of the mountain. The landslide measured approximately 490 meters (1,600 feet) from head to toe and was about 1,100 meters (3,600 feet) wide (Black and others, 1992). Photo by Bill Black of the Utah Geological Survey.



The 1992 St. George earthquake occurred in a region with several major faults that have been quite active during the past 130,000 years and have the potential to generate large earthquakes. The earthquake did not rupture the surface (Black and others, 1992), so it is not certain that it occurred on any of these mapped faults. The epicenter of the earthquake is very near the Washington Fault zone (Figure 1). The fault plane of the earthquake projects to the surface near the Hurricane Fault, a major active fault that trends south from Cedar City to the Grand Canyon. The Hurricane Fault is a normal fault that dips to the west and displaces rocks on the western side downward relative to rocks on the eastern side. Abundant evidence documents the geo-

logically recent activity of the Hurricane Fault, including a 290,000-year-old basalt flow at the town of Hurricane, Utah, that has been displaced about 90 meters (300 feet) by repeated movements on the fault (Hamblin and others, 1981). Fairly young alluvial fans along the fault zone in Arizona have been displaced by a few meters (several feet), suggesting that faulting has occurred within the past 10,000 to 20,000 years (Pearthree and others, 1983; Scarborough and others, 1986). These surface displacements along the Hurricane Fault were most likely produced by paleoearthquakes of magnitude 7+.

The absence of aftershock activity following the 1992 St. George earthquake is intriguing. Typically, an earthquake of magnitude 5.5 to 5.9 would be followed by 10 to 15 aftershocks of magnitude 3 or greater within the first few days after the main event. A magnitude 5 earthquake that occurred near Lake Elsman, California, in 1988 also had no detectable aftershocks. This event preceded the devastating magnitude 7.1 Loma Prieta earthquake of 1989. Other moderate earthquakes in California with weak aftershock sequences, however, were not followed by a larger earthquake. The absence of aftershocks following the St. George earthquake, therefore, does not necessarily imply that a larger earthquake will occur in that area in the near future.

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PROFESSIONAL MEETINGS

Tucson Gem & Mineral Show. Annual exhibit, February 11-14, Tucson, Ariz. Contact Tucson Gem & Mineral Show Committee, P.O. Box 42543, Tucson, AZ 85733; tel: (602) 322-5773.

Arizona-Nevada Academy of Science. Annual meeting, April 16-17, Las Vegas, Nev. Abstract deadline: January 8. Contact Sandra Brazel, Office of Climatology, Arizona State University, Tempe, AZ 85287-1508; tel: (602) 965-6265.

Forum on the Geology of Industrial Minerals. Annual symposium, April 25-30, Long Beach, Calif. Contact Dave Beeby, Chairman, 29th Forum on Industrial Minerals, Division of Mines and Geology, 801 K St., MS 08-38, Sacramento, CA 95814-3531; tel: (916) 323-8562; fax: (916) 327-1853.

Geological Society of America. Cordilleran and Rocky Mountain Sections, annual meeting, May 19-21, Reno, Nev. Abstract deadline: January 26. Contact Richard A. Schweickert, Department of Geological Sciences, Mackay School of Mines, University of Nevada-Reno, Reno, NV 89557-0138; tel: (702) 784-6050.

In Memoriam

Dr. Richard T. Moore, retired Principal Geologist of the Arizona Bureau of Mines, a predecessor of the Arizona Geological Survey, died in August 1992 after undergoing surgery in the Philippines. Dr. Moore spent 26 years as a geologist with the Bureau. He received his B.S. and M.S. degrees from the University of Arizona and his Ph.D. degree from Stanford University. After he retired in 1977, Dr. Moore bought a 42-foot sailboat and cruised the high seas with his wife, Elizabeth. He is survived by his wife, daughter, and two grandsons, all from Tucson.

METEORITES continued from page 6

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