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Damaging Historical Earthquakes in the Afghanistan Region

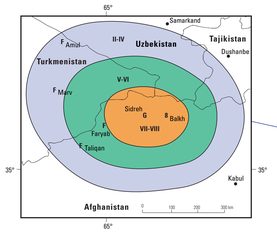
By

Margaret G. Hopper[1], Kenneth S. Rukstales[1], Margo L. Johnson[1], James W. Dewey[1], Eric A. Bergman[2], and Stuart A. Sipkin[1]

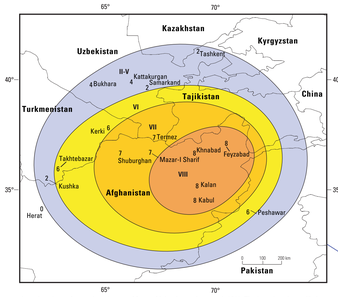
[1]U.S. Geological Survey, Denver, Colorado, 80225
[2]Global Seismological Services, Golden, Colorado, 80401

2006

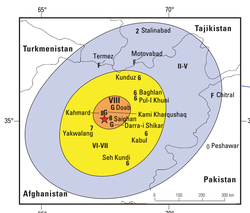
This poster summarizes the reported effects of earthquakes in Afghanistan and surrounding regions from 734 to 2004, including a map of the seismicity of the Afghanistan area (central map) and 13 isoseismal maps for selected historical earthquakes.



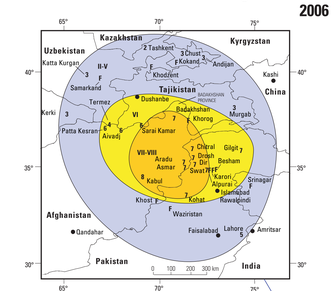
Isoseismal map for earthquake near Balkh, Afghanistan, June 819.



Isoseismal map for earthquake near Mazar, Afghanistan, January 1, 1911. The isoseismal map likely shows the effects of the January main shock (M 6.8) and a large (M6.5) aftershock 4 hours later, and it may be influenced by effects due to a great (M7.8) earthquake that occurred 3 days later in Kazakhstan.



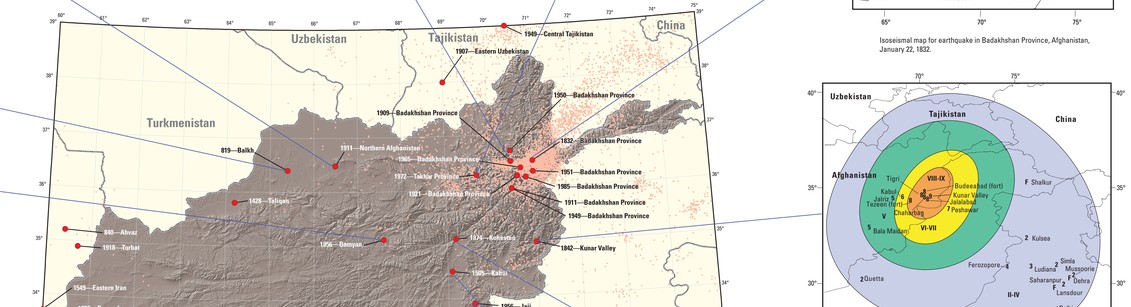
Isoseismal map for earthquake near Bamyan, Afghanistan, June 9, 1956.



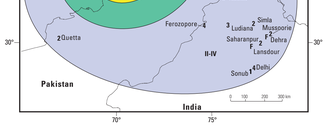
Isoseismal map for earthquake in Badakhshan Province, Afghanistan, July 7, 1909.

Isoseismal map for earthquake in Takhar Province, Afghanistan, June 24, 1972.

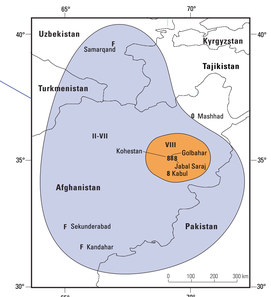
Isoseismal map for earthquake in Badakhshan Province, Afghanistan, January 22, 1832.



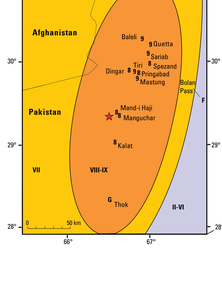
Recorded earthquakes in and near Afghanistan through mid-December 2004. The small pink dots show all documented earthquakes in the area from the "Summary Catalog of Afghanistan Earthquakes" that is documented in Chapters A and B of this report and included as a digital file on the report CD-ROM. The large red dots indicate earthquakes of magnitude 7.5 or greater or with maximum Modified Mercalli intensity VIII or greater. Lines connect the epicenters to isoseismal maps of earthquakes for which sufficient intensity data are available to make such maps. Topography is from the Shuttle Radar Topography Mission (SRTM) Digital Elevation Model of Afghanistan by Chirico and Barrios (2005).



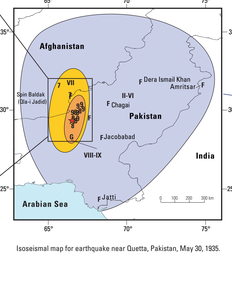
Isoseismal map for earthquake in the Kunar Valley, Afghanistan, February 19, 1842.



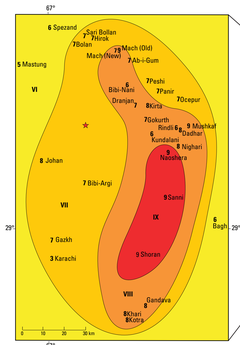
Isoseismal map for earthquake near Kohestan, Afghanistan, October 18, 1874.

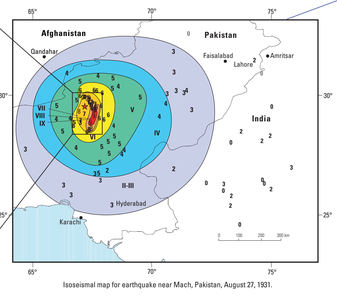


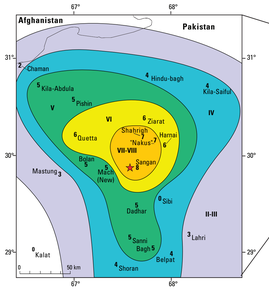
Isoseismal map for earthquake near Quetta, Pakistan, May 30, 1935.

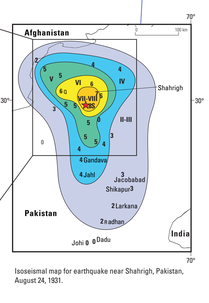


Isoseismal map for earthquake near Mach, Pakistan, August 27, 1931.

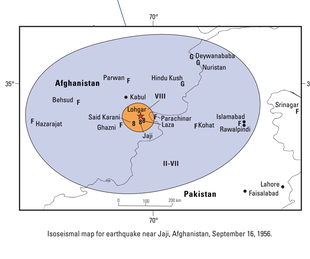




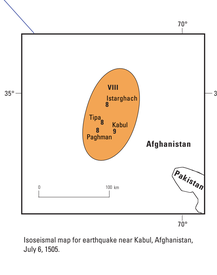




Isoseismal map for earthquake near Shahrigh, Pakistan, August 24, 1931.



Isoseismal map for earthquake near Jaji, Afghanistan, September 16, 1956.



Isoseismal map for earthquake near Kabul, Afghanistan, July 6, 1505.

The contoured maps above show site intensities (Arabic numerals corresponding to the Roman numerals of the Modified Mercalli intensity (MMI) scale top right of this plate) that were assigned by the authors to macroseismic data reported by Ambraseys and Bilham (2003a,b). The contours (isoseismals) in these figures enclose regions where the predominant level of shaking (denoted by the Roman numeral within each colored isoseismal area) corresponds to a description in the MMI scale. A range (for example, VII–VIII) is used where data were insufficient to define separate contours, and the color shown is that of the lowest value in the range. A red star marks an epicenter determined by instrumental data. "F" indicates that the earthquake was felt at the town, but data are insufficient to assign an intensity. "G" indicates sites of reported ground failures. "0" indicates a site where the earthquake was reported as not felt. MMI "I" indicates a site where the earthquake was reported not felt, but effects attributed to the earthquake were observed, for example, a change in the flow rate of a hot spring.

The Modified Mercalli Intensity Scale

An earthquake intensity scale describes commonly observed earthquake effects in order of severity. The scale is designed to estimate the level of shaking at a site when instrumental recordings of earthquake waves are not available. Because the shaking level is not the sole determinant of observed damage, the scale also considers the type and quality of contruction at the site. Because ground and water effects are observed over a wide range of intensity levels, such effects are poor indicators of shaking level and therefore are not included here.

The effects listed below are selected from the entire Modified Mercalli intensity scale (Wood and Neumann, 1931) and from the 1956 modifications of Richter (1958, p. 136–138).

I. Not felt. Long-period effects of large earthquakes, sometimes experienced near or beyond the margin of the area of perceptible shaking, such as dizziness, nausea, slow swaying of structures, liquids, bodies of water (seiches), chandeliers, doors.

II. Felt indoors by a few persons at rest, especially on upper floors of buildings.

III. Felt indoors by several people. Hanging objects swing. Vibration like passing of light trucks.

IV. Felt indoors by many people, outdoors by few. Windows, doors, dishes rattle. Vibration like passing of heavy trucks or sensation like a heavy body striking building or heavy objects falling inside.

V. Felt by most people; frightened a few; a few run outdoors. Vases and small unstable objects are overturned, fallen, some broken. Small furnishings and objects displaced. Hanging pictures, shutters, doors swing; pendulum clocks stop, start, change rate.

VI. Poorly built masonry structures or weak materials such as adobe are cracked. Plaster is cracked. Some windows and much glassware are broken. Many knickknacks, books are knocked off shelves. Moderately heavy furniture is displaced or overturned.

VII. Poorly designed or built masonry structures, adobe houses, old walls (especially those without mortar) are cracked and damaged. Ordinary masonry structures are somewhat cracked. Weak chimneys are broken at roof line; many chimneys cracked. Loosened brickwork, stones, tiles, plaster, cornices, unbraced parapets are shaken down. Many windows are broken. Heavy furniture is overturned. Concrete irrigation ditches damaged.

VIII. Ordinary masonry structures are considerably damaged, partially collapsed. Well-built masonry structures are somewhat damaged. Frame buildings are somewhat damaged, and moved on foundations if not bolted down. Some masonry walls are fallen, many seriously cracked. Chimneys, monuments, towers, elevated tanks are twisted or fallen. Branches are broken from trees. Very heavy furniture is overturned.

IX. Poorly built masonry structures, adobe houses are destroyed. Ordinary masonry structures are heavily damaged, sometimes with complete collapse. Well-built masonry structures are seriously damaged. Frame structures are fallen off foundations if not bolted down. Frames are racked. Reservoirs are seriously damaged.

X. Most masonry and frame structures are destroyed with their foundations. Some well-built wooden structures and bridges are destroyed. Dams, dikes, embankments are seriously damaged. Railroad rails are bent slightly.

XI. Few, if any, masonry structures remain standing. Wood-frame structures severely damaged. Dams, dikes, embankments greatly damaged. Well built bridges destroyed. Railroad rails bent greatly.

XII. Damage nearly total. Practically all works of construction greatly damaged or destroyed.

Modified Mercalli intensities assigned to individual sites are shown on the contoured maps at left. The contours (isoseismals) in those figures enclose regions where the predominent level of shaking, denoted by the Roman numeral within each colored isoseismal area, corresponds to a description in the Modified Mercalli intensity scale. A range (for example, VII–VIII) is used where data were insufficient to define separate contours, with the isoseismal area's color being that of the lowest value in the range.

Significant historical earthquakes in the region of Afghanistan. This table lists earthquakes of magnitude 7.5 or greater or with maximum Modified Mercalli intensity VIII or greater (Bergman and others, 2006). Depth "u" indicates an unknown depth. — indicates a lack of data.

Year	Mo	Day	Hour	Min	Latitude N.	Longitude E.	Depth km	Magnitude	Max Intensity	Comment (abstracted from Ambraseys and Bilham, 2003a, b; and Ambraseys and Melville, 1982)
734	—	—	—	—	31.600	60.500	u	6.5	8	Sistan Province, Iran. An earthquake "such as no one had experienced before."
805	12	2	—	—	29.500	60.500	u	7.0	9	Sistan Province, Iran.
815	—	—	—	—	29.500	60.500	u	7.0	9	Sistan Province, Iran.
819	6	—	—	—	36.400	65.400	u	7.4	8	Balkh, Afghanistan. Destroyed one-quarter of the city of Balkh and ruined the masjid-i jami there. Many houses destroyed, heavy casualties in Balkh, Faryab, Taliqan and districts of Juzjan and Tukharistan to the west and east of those places. The desert near Sidreh was flooded and made fertile, creating new permanent oases. Aftershocks.
840	7	—	—	—	35.200	60.400	u	6.5	8	Ahvaz, Iran. In Ahvaz many houses, including the masjid-i jami, were destroyed and the people left the city. The hill overlooking Ahvaz was fissured. Aftershocks.
1428	—	—	—	—	35.800	64.200	u	6.5	8	Taliqan, Afghanistan. Many killed, destructive. Shocks continued 10 days.
1505	7	6	—	—	34.500	69.100	u	7.3	9	Kabul, Afghanistan. Ruined ramparts of fort and walls of gardens in Kabul. At the time of the earthquake, Babur was outside Kabul, preparing for his campaign against Kandahar; it took him about a month of hard work to repair the fort at Kabul. Destroyed all houses in Paghman, most in Tupi, killed 70-80 in Paghman and many more in nearby villages. Near Istarghach in some places the ground rose as high as an elephant, in others, sank as deep; vertical offset along the fault about 3 m. Landslide in the valley just north of Paghman. Many aftershocks lasting 1 month.
1549	2	15	24	—	33.700	60.000	u	6.7	8	Eastern Iran. Completely destroyed five villages, killing 3,000. Predicted by a local astrologer, who was killed in the shock.
1832	1	22	—	—	36.500	71.000	180	7.4	9	Badakhshan Province, Afghanistan. Destroyed most of the villages in the district (together with the aftershock on February 21), killing thousands. In Kalafgan all forts and houses were destroyed, killing many. In nearby towns about one-half of the people were killed. A large landslide dammed the Varaduj River for 8 days. A long series of aftershocks followed, unusual for an earthquake thought to be 180 km deep.
1842	2	19	11	40	35.000	71.000	u	7.5	9	Kunar Valley Afghanistan. At Jalalabad the Kabul gate collapsed, 2.4 km of parapets were damaged, and breaches were made in the east face. Within the walls one-third of the houses were destroyed, choking the streets and leaving no room for escape. Outside the walls along the river the ground opened and water appeared on the surface. The river was thrown from its bed twice. The Villages of Chaharbag and Tigri were ruined, killing hundreds. In the Kunar Valley landslides were triggered, and two forts were totally destroyed. Near Peshawar many of the camels carrying baggage for the troops were thrown down.
1874	10	18	—	—	35.100	69.200	u	7.0	8	Kohestan, Afghanistan. Kohestan, Golbahar, and Jabal Saraj were almost totally destroyed and had many casualties. The ground opened up, presumably due to liquefaction, near Jabal Saraj.
1907	10	21	4	23	38.000	69.000	35	7.2	9	Eastern Uzbekistan.
1909	7	7	21	37	36.500	70.500	230	7.6	8	Badakhshan Province, Afghanistan. Estimated to be 230 km deep, this earthquake caused few deaths and little damage for its magnitude. Maximum effects occurred along the Kunar Valley from Chitral to Asmar; a hospital was damaged in Swat, and between Swat and Dir houses collapsed without fatalities. Rockfalls destroyed key posts, disrupted telephone lines, and blocked many passes into Badakhshan where summer camps were destroyed. In Kabul several houses collapsed and about 10 people and many cattle were killed. Many aftershocks occured.
1911	1	1	10	18	36.500	66.500	50	6.8	8	Northern Afghanistan. Effects of two earthquakes about 4 hours apart cannot be separated. At Feyzabd, Khanabad, Kalan, and Kabul many houses collapsed, killing hundreds of people (300 houses and 400 people in Kabul alone).
1911	3	4	13	33	36.000	70.500	190	7.4	8	Badakhshan Province, Afghanistan.
1918	3	24	23	14	34.800	60.700	u	6.0	8	Torbat, Iran.
1921	11	15	20	36	36.204	70.676	135	7.6	—	Badakhshan Province, Afghanistan.
1931	8	24	21	25	29.810	67.534	10	6.7	8	Shahrigh, Pakistan. First of two earthquakes in 3 days. Shahrigh was half destroyed and two people killed; its bazaar of unbaked mud was completely ruined, and buildings of sun-baked brick and mud mortar were severely damaged; the railway station was badly cracked and its chimney pots overturned. Nakus, 14 km east-southeast of Shahrigh, was similarly damaged. Between Shahrigh and Nakus a railway bridge was damaged, stopping traffic for a few days.
1931	8	27	15	27	29.503	67.176	33	7.2	9	Mach, Pakistan. Killed only 129 because people were sleeping outdoors following the Shahrigh earthquake 3 days earlier. At Mach damaged all buildings and ruined those of unbaked mud bricks or stone with mud mortar; train driver was thrown from engine but train did not derail; 400 prisoners escaped from the badly damaged new jail but were subsequently caught; most public buildings in Old Mach were totally ruined. Most to all of the houses collapsed in the towns from Mushkaf to Khari, killing people and cattle. In the nearly uninhabited region west of these towns most roads and tracks across the ranges were blocked by rockfalls and the few levy posts and small, semi-abandoned villages were ruined. Large rockfalls killed flocks of sheep and raised big dust clouds.
1935	5	30	21	32	29.329	66.506	10	7.6	9	Quetta, Pakistan. Completely destroyed the low-lying part of Quetta, killing 15,000 people in Quetta alone. Damage to rural houses in Kandahar region.
1936	6	30	19	26	33.600	60.000	u	6.0	8	Bamrud, Iran.
1949	3	4	10	19	36.000	70.500	230	7.4	8	Badakhshan Province, Afghanistan.
1949	7	10	3	53	39.000	70.500	16	7.5	10	Central Tajikistan.
1950	7	9	16	10	36.700	70.500	223	7.5	—	Badakhshan Province, Afghanistan.
1951	8	12	22	40	36.300	71.000	223	7.5	—	Badakhshan Province, Afghanistan.
1956	6	9	23	13	35.111	67.576	27	7.5	8	Bamyan, Afghanistan. The few small mountain villages in the epicentral area were either totally destroyed or heavily damaged, and about 70 people were killed. The largest landslide dammed a river for 4 days, causing a flood that swept away villages in the valley and drowned about 350 people. Other landslides blocked roads, disrupted communications, and killed a number of domestic animals.
1956	9	16	8	37	33.899	69.583	25	6.7	8	Jaji, Afghanistan. In the epicentral area some houses collapsed and a few people were killed. Landslides and snow avalanches.
1965	3	14	15	53	36.377	70.720	214	7.5	7	Badakhshan Province, Afghanistan.
1972	6	24	15	29	36.268	69.709	27	6.1	8	Takhar Province, Afghanistan. Villages within a radius of about 25 km were ruined; a few hundred houses collapsed and about 20 people were killed.
1985	7	29	7	54	36.163	70.863	100	7.4	8	Badakhshan Province, Afghanistan.

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