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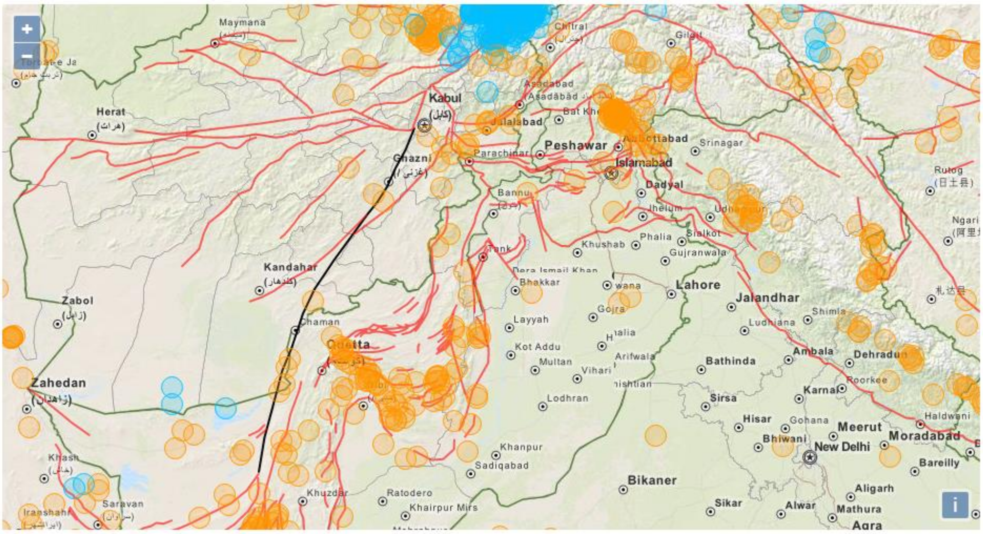
Chaman Fault



Earthquakes:

☑ Show earthquakes

Earthquake catalogue:

○ TIPAGE (2008 - 2010)
◉ ANSS ComCat (1900 - 2014)

Magnitude:

○ All ○ < 5 ◉ > 5

Depth:

◉ All ○ < 70km ○ > 70km

Fault
Magnitude > 5
Magnitude < 5
Depth > 70 km
Depth < 70 km
Nura Earthquake Aftershocks

Name	Chaman Fault
comments	Also known as the Chaman Fault System. Ruleman et al. (2007) subdivided the system into four subsidiary systems including Chaman fault, Mokur fault, Gardiz fault, and Paghman fault

Geographic characteristics

Country	Afghanistan, Pakistan
Exposure	Exposed

Seismic characteristics

Geodetic slip rate (mm/yr)	5.4 - 16.8
comments	Based on geodetic observations, E. Apel (written commun., 2006, in Yeats, 2012) reported 26 mm/yr for the Chaman fault. This rate is close to that of 29.7 mm/yr predicted for relative movement of India toward Eurasia in this region (Sella et al., 2002). Mohadjer et al. (2010) used differences in velocities between GPS sites spanning most of the northern end of the Chaman Fault and placed a lower bound on the slip rate of 18 ± 1 mm/yr across this region. Furthermore, they estimated a rate of 5.4 ± 2 mm/yr of sinistral shear across the Gardiz and Mokur faults at the northern section of the Chaman Fault zone. Continental scale geodesy indicates that India's relative velocity with respect to Eurasia at the longitude of the Chaman fault system is 24-28 mm/yr of which 15.1 mm/yr is accommodated by the Ornach Nal fault and the central and southern Chaman fault (Szeliga et al., 2012). At latitude 33 degrees N and further north, InSAR data indicate a velocity across the Chaman fault of 16.8 ± 2.7 mm/yr near Qalat, Afghanistan (Szeliga et al., 2012). Based on GPS observations, the authors also reported 16.8 ± 0.51 mm/yr of sinistral motion near Kabul, Afghanistan.
InSAR	At latitude 33 degrees N and further north, InSAR data indicate a velocity across the Chaman fault of 16.8 ± 2.7 mm/yr near Qalat, Afghanistan (Szeliga et al., 2012). Based on GPS observations, the authors also reported 16.8 ± 0.51 mm/yr of sinistral motion near Kabul, Afghanistan.
Geologic slip rate (mm/yr)	2 - 40
comments	Based on the degree of topographic disturbance caused by the fault, Wellman (1965) suggested a present-day average slip rate of 2-20 mm/yr. Beun et al. (1979) suggested an average slip rate of 25-35 mm/yr over the last 2 My across the whole fault zone based on the correlation of Pliocene offset of volcanic units that straddle the fault north of Ab-e-Istada in Afghanistan. Geologic and plate closure estimates suggest sinistral slip across the Chaman fault system of between 19 and 35 mm/yr over the last 25 Ma (Lawrence and Yeats, 1979). NUVEL-1 global plate motion model of DeMets et al. (1990) predicts a rate of about 40 mm/yr for the Chaman Fault. Lawrence et al. (1992) reported 19-24 mm/yr over the last 20-25 My as a minimum slip rate assuming slip began just after the end of deposition of the Khojak Flysch. Yeats (2012) concluded that the slip rate on the Chaman Fault is high enough that the next earthquake is overdue, even assuming that some of the plate boundary slip maybe aseismic or on slow earthquakes. Although poorly constrained, Molnar et al. (2010) believe that the rate of slip on the Chaman Fault is >10 mm/yr and most likely between 20 and 30 mm/yr.
Historic earthquake	There are at least four major strike-slip earthquakes with M > 6 recorded historically on the Chaman fault: the 1505 earthquake (Ms 7.3) west of Kabul, the 1892 (Ms. 6.5) earthquake near the city of Chaman, the 1975 earthquake between Chaman and Nushki and the 1978 earthquake north of Nushki in Pakistan. No major historical earthquakes are noted between the 1892 Chaman rupture to the southern terminus of the 1505 rupture which made Bernard et al. (2000) and Ambraseys and Bilham (2003a) conclude that a significant slip deficit exists along the Chaman fault, especially north of ~31 degree latitude. The region east of the Chaman fault underwent two large earthquakes, the Mach earthquake of 27 August 1931 of Ms 7.3 in the Sibi re-entrant between the Brahui and Sulaiman ranges, and the Quetta earthquake of 30 May 1935 of Ms 7.7. The epicenter of the Quetta earthquake was close to the Ghazaband fault. Ambraseys and Bilham (1992), however, were unable to attribute the reported surface deformation to a source fault. Recent seismicity along the fault appears to be mostly small earthquakes (M 3-5), located mostly in regions with major historical seismicity. The M5 earthquake in 2005 ruptured the surface along the 6.5 km of the Chaman fault south of Kabul. The slow slip observed over a year after this event raises the possibility that other parts of the fault might rupture in slow slip events (Yeats, 2012).
Geomorphic expression	Earthquakes along the Chaman fault appear to consistently rupture to the surface. Oldham (1883) and Babur (1912) reported surface ruptures for the 1505 earthquake near Kabul. Griesbach (1893) observed surface rupture from the 1892 Chaman earthquake which offset railroad tracks crossing the fault by 0.75 m. No surface rupture has been reported for the 1975 Ms 6.7 earthquake which occurred between Nushki and Chaman in Pakistan. The 1978 Mw 6.1 earthquake near Nushki ruptured the surface (Yeats et al., 1979). Wellman (1965) reported stream offsets of 20-120 m. Active fault features consistent with the 1892 surface rupture are described by Lawrence and Yeats (1979).

Structural characteristics

Primary sense of motion	Sinistral (left-lateral); Strike-slip
comments	Ruleman et al. (2007) reported active frontal thrust faults along western margin of the Chaman fault. These arcuate, northwest-directed, east-dipping, frontal thrusts are second-order structures that result from the combination of compression and strike-slip motion on the Chaman fault system. Some of these thrust faults are >20 km long and extend >10 km west of the main fault trace. Multiple strike-slip fault strands are proximal to these thrust faults.
Length	> 850 km

References

Ambraseys and Bilham (2003b); Beun et al. (1979); DeMets et al. (1990); E. Apel (written commun., 2006); Griesbach (1893); Lawrence and Yeats (1979); Lawrence et al. (1992); Molnar et al. (2010); Sella et al. (2002); Szeliga et al. (2012); Wellman (1966); Yeats (2012)