Geophysical Research Abstracts, Vol. 7, 00987, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00987

Three-dimensional velocity structure and orientation of the causative fault for the 2003 Bam earthquake, Iran

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The December 26, 2003, Bam earthquake is one of the most catastrophic Iranian earthquake. The earthquake struck the ancient city of Bam, destroyed almost all houses in and around the city and killed 26,271 people, near 19 percent of the total population (*Statistic Center of Iran, 2004)*. Just after the earthquake it was supposed that the mainshock had occurred in the well-known geological Bam fault. However, nobody could find any clear evidence of dislocation on this fault. The mainshock was followed by thousands of aftershocks. Aftershocks allow us to image velocity structure and the fault geometry in three dimensions. We installed a temporal high sensitivity seismic network in and around the Bam city on February 6, 2004, 6 weeks after the mainshock, and monitoring continued until 7 March 2004. We used high-quality manually picked arrival times of 19640 P and 19639 S waves for 2421 aftershocks to determine high resolution three-dimensional P and S wave velocity and Poisson's ratio structures in the Bam epicenteral area and relocated the aftershocks with the obtained three dimensional velocity model. Precise hypocenters propose the existence of a north-south trending source-fault which is causative of the Bam earthquake and locates about 4 km west and in parallel of the geological Bam fault. We named it the Arg-e- Bam fault to distinguish from the Bam fault. The Arg-e-Bam fault is a nearly vertical and right lateral strike slip fault with about 20 km strike-ward length and 15km width dip-ward from northeastern Bam city to south direction. Significant velocity variations of up to 5% are revealed in the aftershock area. Low P and high S wave velocity (low Vp/Vs) exist in the fault zone in the depth range of 2 to 5 km. The low P wave velocity dips

toward the south and extends to 8 km. This low Vp/Vs zone corresponds to a seismic gap in the center and high aftershock activities in its both sides. This anomaly which shows low Poisson's ratio corresponds to the main part of the fault including the big slip zone. The deeper parts are characterized by high P and low S wave velocity (high Vp/Vs) and high Poisson's ratio. The maximum anomaly of high Vp/Vs which exists in the depth range from 7 to 12 km at 29.06N to 29.12N may include the starting point of the mainshock rupture.