

Macroseismic investigation of Jaisalmer earthquake of 9th April 2009

Western Rajasthan experienced a mild earthquake on 9th April 2009, at approximately 0717hrs for 15-20 sec. The epicentre lay about 27 km NW of Jaisalmer city. The event left damaging affects in and around Jaisalmer and Ramgarh towns causing cracks in some buildings and injury to a few persons. The shocks were felt as far as Jodhpur, Pokharan and Barmer.

Earthquake parameters, as obtained from the Indian Meteorological Department (IMD), are as follows:

- Date - 9th April 2009
- Origin time - 07hrs 17 min (IST)
- Epicentre Coordinates - 21.7⁰N ; 70.7⁰E
- Magnitude - 5.3 on Richter scale
- Focal depth - 33 km?

Geological Survey of India, the nodal organization for conducting macroseismic survey in the country, took a lead and organized a study of the earthquake. The area, featuring the sandy tract of Thar Desert, rocky, low relief mounds and plains of Rajasthan, geologically marks the cover sequence of different tectonic framework, ranging in age from Late Proterozoic to Recent. Major part is covered by Cenozoic Pericratonic fills on the attenuated continental crust (cpr) (GSI-2000). The Quaternary sediments of Aeolian and fluvial origin constitute the Thar desert and mask the older formations.

Based on the ground validation, particularly on human perceptibility, isoseismals have been drawn by following the MSK-64 intensity scale. Maximum intensity interpreted is VII around villages Chandna – ki – Dhani, Gafoor – ki- Dhani and Kurchi area. The meizoseismal zone encompassing an area of 400 sq km lies on the western proximity of instrumentally recorded epicentre at Mokhal.

In isosiest VII, most people got frightened and ran outside, some even lost balance. Most houses of Types A and B developed cracks of grade II and I. In Chandna-ki-Dhani, 21 houses of Type B got fully damaged while 3 were severely damaged. In many houses, like school building in this village, wall cohesion was almost lost. In Anganbari building of Kurchi village the load bearing E-W wall failed and the steel

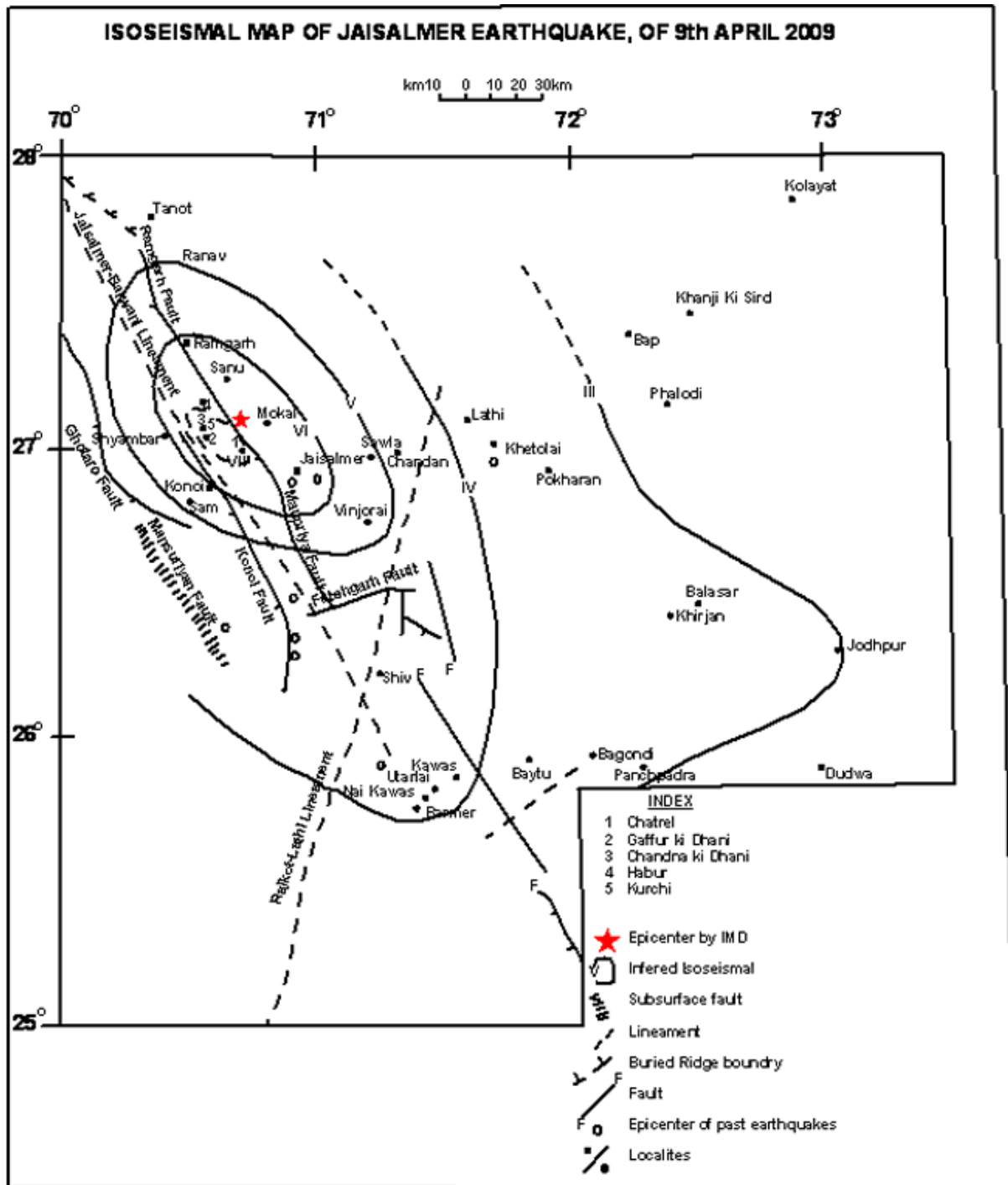
support on the ceiling fell. Partial collapse of Old Bhurj (Fort) in Salka and a few houses in Kurchi, Chetral (eastern wall), etc., were observed. In Gafoor – ki- Dhani and Chandna-ki-Dhani, ‘sand blow’ was reported. Possibly, the entrapped air got ejected out and was accompanied by a characteristic sound, which perhaps gave the illusion of gas eruption.

The plot of the isoseismals indicates that Isoseist VI aligned almost NW-SE, similar to isoseist VII and encloses an area of about 2600 sq km. Important localities in this isoseist are Jaisalmer town, Lanela, Mokal, Sanu, Ramgarh, Habur, Damodra, Lodarva, Kanoi, Shyambar, etc. Most people felt the shock and got frightened. Domestic animals ran outdoors and birds started chirping. Many buildings of Type B, in Jaisalmer and Ramgarh developed grade 2 cracks, prominent being RTDC Guest House / Hotel, Gaffor Batta, PWD office and Guest House, Girls School, Circuit House, Railway Station, etc. In Kishnai Devi Mangi Ram Girls Higher Secondary School (Jaisalmer), physics lab building was the worst affected where a portion of four walls and floor got separated from the building, with openings of 2-4 cm across the wall. The grade IV damage in this type B structure completely disturbed the cohesion of the building.

The macro seismic study has revealed that:

1. The NW-SE trending isoseismals are aligned almost parallel to the regional tectonic planes and follow the spatial trend of past seismicity.
2. The epicentral tract lies bounded by Ramgarh Thrust in the east and Jaisalmer – Barwani lineament (a surface expression of deep seated crustal fault) in the west. The basement configuration in this area displays a complicated pattern, probably reflecting the highly faulted nature of the basement.
3. The mechanism of this event has not been studied, but continued seismic disturbances, particularly shallow earthquakes (< 45km depth) along this zone, suggest reactivation of these faults during Recent times, closely following the NNW-SSE trend.

Suggestions: The programme for repair/retrofitting of damaged and unsafe structure should be immediately taken up on priority basis. Field observations revealed that the damages in building structures were mainly due to inadequacy of design, taking care only of gravity load. However, keeping in view the seismotectonic set-up, it is recommended to take care of seismic forces in the design.



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Figure 1: Isoseismal Map of Jaisalmer Earthquake 9th April 2009



Figure 2: Conjugate joint in wall of School building in Chandan-ki-Dhani



Figure 3: Failure of load bearing E-W wall of Anganbari building in Kurchi village



Figure 4: Partial collapse of wall of a school building in Mokhal



Figure 5: Inverted cone like cavities formed due to escape of trapped air during tremors in Gafoor-ki-Dhani.



Figure 6: Subsidence in the floor of Kishnai Devi Mangi Ram Girls Higher Secondary School



Figure 7: Horizontal cracks developed in pillar of Jain temple Amar Sagar, Jaisalmer



Figure 8: Opening of Joint in Jaisalmer fort