
Intraplate earthquakes - why?

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More than 90 per cent of the world's earthquakes take place at active plate margins, where the major plates interact at velocities of up to 100 mm/year. These zones are also host to the world's largest earthquakes, such as the 1960 Chilean and the 1964 Alaskan earthquakes. These had moment magnitudes of 9.5 and 9.2 respectively, and ruptured a total of approximately 1800 km of the earth's crust.

The tectonic models to describe these earthquakes are well known and well understood. However, earthquakes occurring away from the plate boundaries, (i.e. intraplate earthquakes) such as those in the Australian continent, are poorly understood and they do not form well defined patterns in space or time.

Nevertheless, we do know that the cause of these earthquakes is compressive stress in the crust and that most of the earthquakes are in the upper crustal basement rocks. Furthermore, these earthquakes occur close to the free surface, which cannot sustain large stresses, and therefore are unlikely to be as large as the giant events that take place at the active boundaries.

The largest known earthquake this century in Australia occurred in 1906 off the northwest coast of the continent. It had an estimated magnitude of 7.2. On land the 1941 Meeberrie earthquake which had a magnitude of approximately 7.0, appears to have been the largest. A maximum credible earthquake of magnitude 7.5 is therefore not unreasonable for calculations of earthquake risk.

This assumption is supported by studies of Recent prehistoric fault scarps. No scarp longer than 45 km has yet been found.

Table 1 shows fault scarps produced by recent earthquakes in Australia, and the magnitudes of the earthquakes. Clearly if these earthquakes had occurred in densely populated regions, there would have been considerable damage.

Table 1. Recent earthquakes that produced fault scarps

<i>Earthquake</i>	<i>Date</i>	<i>Magnitude (Ms)</i>	<i>Fault length (km)</i>	<i>Maximum surface displacement (m)</i>
Meckering WA	14 Oct 1968	6.8	37.0	2.5
Calingiri WA	10 Mar 1970	5.5	3.5	0.3
Cadoux WA	2 Jun 1979	6.0	15.0	1.3
Marryat Creek SA	30 Mar 1986	5.8	13.0	0.8
Tennant Creek NT	22 Jan 1988	6.8	35.0	2.0

Figure 1 shows the distribution of all known earthquakes with magnitude 4 or greater from 1873 until 1990. This diagram indicates that most earthquakes in the Australian region take place within the continental rather than the oceanic lithosphere, that the earthquakes occur throughout most of the continent, and are not usually associated with

MAXIMUM FELT INTENSITY 1900 - 1996

