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The Long Precursory Phase of Most Large Interplate Earthquakes

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It has long been known that many earthquakes are preceded by foreshocks. However, the mechanisms which generate foreshocks and the reason why they occur before some shocks and not others remain unknown. We show, by analyzing seismic catalogs in some of the world best documented areas, that there is a remarkable contrast between the earthquakes which take place along the interfaces of the tectonic plates and the ones which result from the internal deformation of the plates. Most of the large ($M \geq 6.5$) shallow plate-interface earthquakes which have occurred in the well-instrumented areas of the North Pacific over the past 12 years have been preceded by an acceleration of seismic activity, indicating the presence of foreshocks. The location of these shocks and the contrast observed with intraplate earthquakes, for which foreshocks are much less frequent, suggest that the plate interface begins to slip slowly long before it ruptures. If these results are confirmed, the relatively long duration of this precursory phase may help mitigate earthquake risk in the future.