# The 2003 Miyagi-Oki Intraslab Earthquake And Its Aftershock Sequence: A Case in Favor of Strong Faults at Intermediate Depths


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In subduction zones, earthquakes at depths between 60 and 100 km occur within the subducting slab rather than at the slab interface. The presence of fluids resulting from dehydration reactions in the medium would favour these earthquakes (by fluid embrittlement), but the relation between the two processes is yet not fully constrained.

We study the aftershock sequence following the M7.1 2003/05/26 intraslab earthquake which was located off the Miyagi prefecture coast, in Japan. This sequence displays characteristics that are promising for studying relations between seismicity and fluid pressure (high aftershock rate, expanded instrumentation).

The analysis of the catalogue of seismicity and focal mechanisms provides information on the principal characteristics of the aftershock sequence (Omori-Utsu law, Gutenberg-Richter law). In particular, the aftershock sequence follows nearly perfectly an Omori's law with a p-exponent depending on depth. This extremely good agreement between the data and the model appears to be due to the absence of large aftershocks, as confirmed by a significant deviation of the frequency-magnitude relationship from the Gutenberg-Richter law at large magnitudes. An application of the ETAS model to the sequence suggests that most of the sequence would be triggered by the M7.1 itself, i.e the aftershocks play no role in triggering more aftershocks. Moreover, the temporal distribution and inversion of stress field in the small aftershock zone show that, unlike the slab interface, the area inside the slab does not seem to be disturbed by the nearby occurrence of M9 Tohoku-oki earthquake (2011/03/11).

We conclude from our analyses that this intraslab sequence is characteristic of a very critically stressed crustal and upper mantle volume implying strong faults that are not sensitive to large stress perturbations. Moreover, if fluids are involved, then they are likely to be drained off from the top of the activated volume as proved by the depth dependence of the Omori-Utsu's p-value, possibly playing a role in the subsequent occurrence of the 2011 megathrust Tohoku-Oki earthquake which hypocenter is updip this sequence.


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