

Earthquake Prediction in Japan

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On 11 March 2011, M:9.0 Tohoku-oki EQ, with a huge tsunami, occurred resulting in a devastation of the Pacific side of entire northeastern Japan.

The mechanism of generation of this type of EQs is explained by subduction of the Pacific plate. The ways they occur were believed to have been well understood by the asperity model. 400 year record has indicated that large asperity off Tohoku is capable of generating M7 class EQs. Although cascade rupture of more than one asperity was envisaged, maximum possible magnitude was expected to be around 8, but not more.

Thus, the 2011 event indicated that the 400 years were too short for evaluating the regional seismicity. In fact, geologic records of tsunami sediments were indicating that the AD 869 Jogan EQ could have been M9 class. But such geologic information was not taken seriously enough. Some seismologists now deeply repent for this (1).

After the 2011 event, some seismologists claimed that their misjudgment was, at least partially, due to the influence of “comparative subductology”, which was developed in the late 1970s, some 4 decades ago, by me and Prof. H. Kanamori. We proposed that subduction zones can be classified into Chilean and Marianas types by various contrasting features as illustrated in Figs.1a and 1b. The seismologists, who attributed their failure to the comparative subductology, must have thought that Japan subduction zone belongs to the Marianas type. In our view, the Japanese subduction zones are intermediate type, because topographic features are of the Marianas type but Japan Sea ceased spreading many millions of years ago and Japanese mountains are rising now. Actually, Japan is now Chilean type from seismological view point as stated in (2).

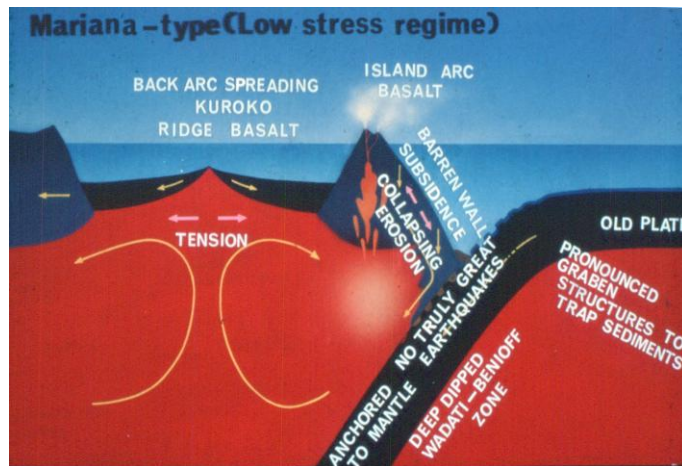


Fig. 1a

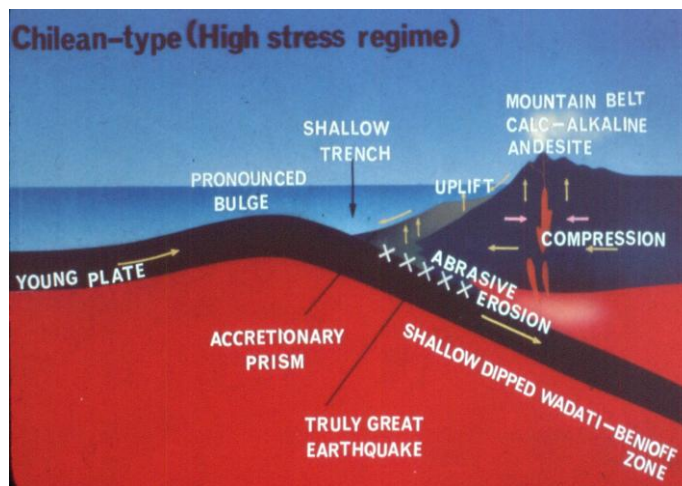


Fig. 1b

In the following, we discuss the EQ prediction in Japan.

Among long-term, intermediate-term and short-term predictions, the last one is most important. Japanese national EQ prediction program was formally started in 1965. Ever since, no successful prediction was made until today. No false prediction either, because not even a single prediction has been announced. The fact is that short-term prediction is not a target of the “national EQ prediction project”. The main cause for this strange situation is more strangely the fact that the “national project” has always been dictated by seismologists. To make the discussion simpler, I will itemize the points.

1. At first, the program was started by strengthening the seismic network. It was quite reasonable for the first step.
2. Strengthening seismic network became an endless enterprise that has monopolized most of funds and

- staff throughout the project.
3. For short-term EQ prediction, precursors are absolutely needed. Usually, EQ precursors are not seismological. Thus, we need non-seismological measurements. But, they were never supported because of item 2.
 4. After the 1995 Kobe EQ disaster, the national program, which never makes any prediction, became a target of severe criticism. The conclusion, after prolonged deliberations, was that short-term prediction should be put aside and efforts should concentrate on the “fundamental research”, namely seismology. “Fundamental research” sounded sweet to the funding agency so that the project not only survived the criticism but funding was even increased.
 5. Because of this, seismology has made great progress. But, hardly any precursory information was obtained.
 6. The justification for the “no short-term prediction policy” was that, despite their hard work, precursors were too difficult to catch. But, this was untrue. They never made serious search of precursors because they knew seismometers would not help.
 7. Their attitude escalated to “decide” that precursors do not exist and research on them should be discontinued because it is useless. Thus, there is practically no government support for any research on EQ precursors now, while the national project promoters enjoy ever increasing funds. Is it not a fraud?
 8. Since EQs are nothing but natural phenomenon, they should be predicted by ordinary scientific endeavors. Indeed, there are already some undeniable signs that prediction is possible.
 9. We are optimistic. But our attitude is far from general acceptance. One reason is the high wall of prejudice depicted above. Another more understandable reason may be that many, if not all, precursors are merely by-products of EQ preparation processes and play no causative roles in EQ generation. Naturally, seismologists are not interested in them. This leads us to the very essence of my argument.
 10. Namely, seismology and the science of EQ prediction are closely related but quite different scientific disciplines. In the absence of the proper name, let us tentatively call the latter discipline as “Predictology”. Non-existence of proper name itself testifies its non-existence. Efforts for “Predictology” have been pursued mostly by non-seismologists, such as physicists, radio engineers, chemists and even biologists, with no national supports. Now is the time, when “Predictology” should be promoted through supporting the fundamental research on precursors. The goal is in our sight.
 11. Regrettably, however, the general situation surrounding the EQ prediction so far is essentially the

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same or even worse after the 1011 Mega-quake. Seismologists lost confidence in general, so that their “Impossibility Myth” has become more prevalent. I deeply deplore this. The situation is rather similar to the Nuclear Energy affairs. Nuclear industry has long been run, under the phony “Safety Myth”

References:

- [1.] 2011 Tohoku EQ: Rebuilding seismology, *NATURE*, vol. 473, 2 May 12, 2011
- [2.] Comparative Subductology: Uyeda, S., and Kanamori, H., Back-arc opening and the mode of subduction, *Journ. Geophys. Res.*, 84, 1049-1061, 1979. Uyeda, S., Subduction zones: An introduction to comparative subductology, *Tectonophysics*, 81,133-159, 1982.