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Research Article

WHY IS EARTHQUAKE PREDICTION THE ONLY RESTRICTED RESEARCH AREA?

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A R T I C L E I N F O

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Earthquake prediction, rigorous process, evidences, Japan Sea, parameters of focal mechanism, mechanical model

A B S T R A C T

Mankind is exploring everything, from the universe to the microcosm. However, mainstream science has a negative attitude to earthquake prediction and even maintains that earthquake prediction is inherently impossible. The public has the right to ask why earthquake prediction is the only restricted research area? Has anyone said it is inherently impossible to explore the Mars? Why discriminate against earthquake prediction only? The success of a medium-term earthquake prediction for a Japan Sea strong earthquake challenged the earthquake prediction skepticism. The paper emphasized the rigorous of prediction process and the solid of its evidences which were first-time published. The success of the prediction based on the model of plate breakup and migration pattern of large shallow earthquakes under the Japan Sea should provide an impetus to similar investigation elsewhere. The paper is good example of an earthquake being successfully predicted in terms of where, when and how big even focal depth. The successful prediction was confirmation of the paleo-rift re-breaked model under Japan Sea. The author is deeply worried about the geological future of the Japanese archipelago.

INTRODUCTION

Mankind is exploring everything, from the universe to the microcosm. However, mainstream science has a negative attitude to earthquake prediction and even maintains that earthquake prediction is inherently impossible (Uyeda *et al*., 2009). The public has the right to ask why earthquake prediction is the only restricted area for scientific exploration? Has anyone said it is inherently impossible to explore Mars? Why discriminate against earthquake prediction only?

However, the weakness and absence of earthquake prediction have aroused public discontent and anger, even causing some interventions of the law. For example, Seven scientists and technicians who analyzed seismic activity ahead of the devastating earthquake that struck the Italian town of L'Aquila on 6 April 2009 had faced trial for manslaughter. The defendants were members of Italy's great risks committee, whose job was to assess risks of potential natural disasters. They were accused by L'Aquila prosecutors of having failed to provide adequate warning of the magnitude-6.3 earthquake that killed 308 people (Cartlidge, 2011).

All the same, there have been really some scientists in the world who are still engaged in the arduous exploration of earthquake prediction (Hayakawa, 2015; Heraud, 2015; Hough, 2010a,b; Huang, 2015; Immè and Morelli, 2012; Main *et al*., 2012).

In view of "the value of long-term forecasts for ensuring seismic safety is clear" (International Commission on Earthquake Forecasting for Civil Protection, 2011), here will particularly mention some hard explorations in the area of medium (or long)-term earthquake predictions:

1. A border strong earthquake (M7.5) between India and Burma (6 August 1988) predicted by Professor H. K. Gupta, Cochin University of science and technology, India (Gupta, 1988);
2. A strong earthquake (M6.0) occurred in Parker Field, California, USA (28 September 2004), although its original idea would have been erupted in 1993, predicted by Professor Thomas McEvilly at the University of California at Berkeley, with Professors William Bakun and Allan lindh at USGS in Menlo Park. Calif. (Bakun and Lindh, 1985);
3. A strong earthquake (M6.6) occurred under the central Japan Sea (7 February 1993) predicted by Mr. Tianxi Sun (Professorial Senior Engineer) (Sun, 1987), who previously worked for East China Hydroelectric Investigation and Design Institute and now Suzhou Environmental Protection Bureau.

Now please allow me to take my this prediction to illustrate what rigorous process in a medium (or long)-term earthquake prediction should be like and what achieved.

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What Rigorous Process in a Medium-Term Earthquake Prediction Should Be Like

Based on a lot of Parameters of focal Mechanism

According to the theory of plate tectonics, submarine earthquakes under the Japan Sea all should be the products of Pacific Plate subducting westward along Japan Trench, and their focal depths all should be 200~510 km. However, I found that it is not applicable fully to all cases. Detailed analysis of over 14,000 parameters of focal mechanism among 530 destructive earthquakes occurred in Far East Asia during the period from 1933 to 1964, I found that two earthquakes of which under the Japan Sea had focal depth of only 30 km (Aver'yanova, 1973). Moreover, the earthquake of M. 7.7 that occurred under the Central Japan Sea on May 26, 1983 also had focal depth of only 40 km (Kenji, 1985). These three shallow destructive earthquakes (see Table 1) could not be interpreted by the plate subduction. They should be caused by another mechanism. Under the Sea of Japan, there must exist another strong tectonic movement.

Table 1 Shallow Strong Earthquakes under Japan Sea

Serial number	Time			The epicenter coordinates		Magnitude (M)	Focal depth (Km)
	Y	M	D	N	E		
1	1940	08	01	44.2 º	139.1 º	7.5	30
2	1950	06	27	43.5 º	139.1 º	6.75	30
3	1983	05	26	39.9 º	138.1 º	7.7	40
4 Coming One	before 1993			In the central part of Japan Sea		more than 7.0	30

(Sun, 1987)

Established a mechanical model

During Tertiary period, the Japan Sea was formed, causing Japan apart from Asian continent. A linear spreading rift was thus formed by this separating. After the sea had a certain scale, the rift stopped its activity and was buried deeply by mud and sand from the continent, forming a huge scar (paleo-rift) in the sea basin. During the latest geological period, Japan Island has been underthrusting toward west very slowly in a form of flexure (Figure 1).

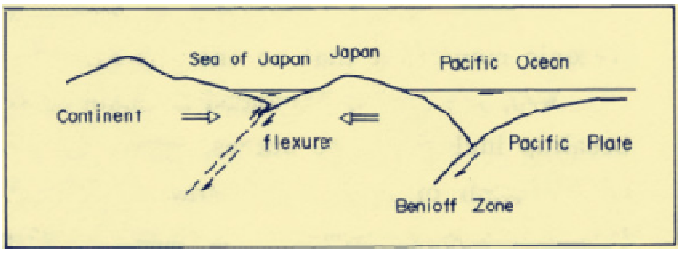


Figure 1 Schematic cross section of tectonic model of Japan Island-Arc

*The broken lines of which shows the flexure underthrust movement under the Japan Sea.

As a result of the underthrusting, there existed some submerged paleo-forests of about 2,000 years old on the shelf near Toyama (Fuji *et al*., 1986). This meant that the western coast of Japan submerged 20 meters and retreated 10 meters during the recent 2,000 years. Marginal seas having Island-arc were more than one place in the world, but why did not exist such submerged paleo-forests in other marginal seas, besides the Japan Sea? It was also pointed out that heat flow was high in the Japan Sea, showing an unusual state in its mantle.

The epicenters of the above three strong earthquakes occurring Japan Sea are shown in Figure 2 (please contrast with Table 1), based on the data (Aver'yanova, 1973), which was translated from a Russian earthquake book.

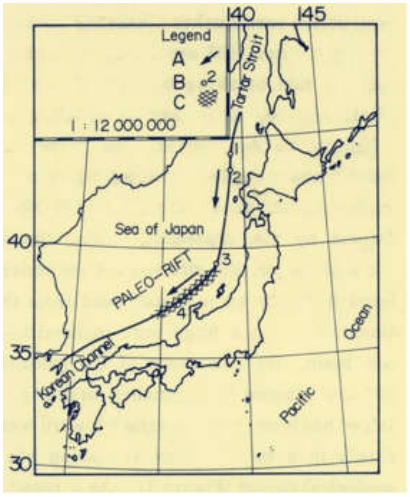


Figure 2 Paleo-rift, recent strong shallow earthquakes and possible range of coming shallow earthquake in the Central Japan Sea（sketch map)

*A: migration direction of strong shallow earthquakes; B: epicenters of the strong shallow earthquakes in the Japan sea; C: possible range of the epicenter of forecasted earthquake.

These three quakes all occurred along the paleo-rift of the Japan Sea, and had the same mechanism of thrust fault (Aver'yanova, 1973; Kenji, 1985). Seeing the clear pattern of south migration of the foci shown in Figure 2, I hypothesized that the northern end of the paleo-rift was affected firstly by the underthrusting of Pacific Plate, thus causing tectonic stress concentrated to the northern part of the rift and erupted strong shallow earthquake firstly. This showed that the paleo-rift re-breaked at northern part first then propagate to south. The three destructive earthquakes mentioned above, might be caused by this breaking course.

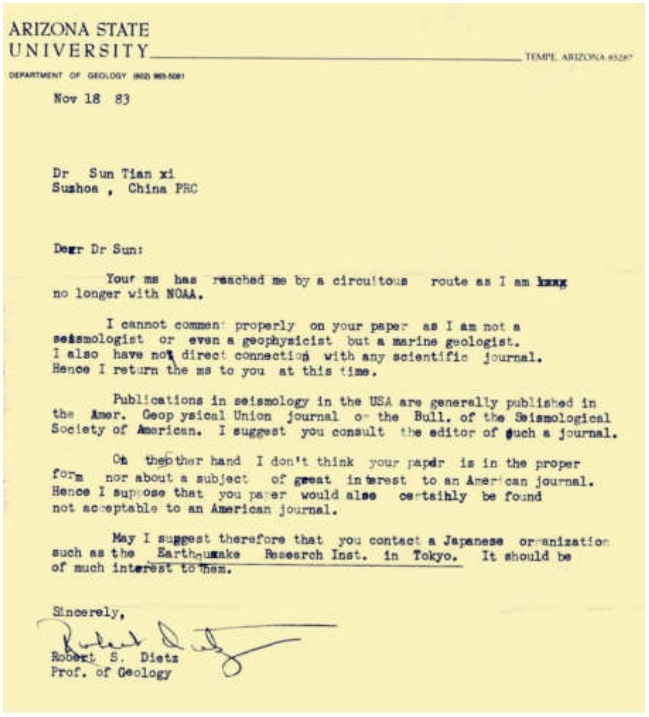
The 4 in Figure 2 is an inflection point. The stress concentration at the inflection point will cause a temporary rebound of stress, leading to subsequent strong shallow earthquakes happen in deeper focal depths within such an area (between 1 and 4 in Figure 2), which means the paleo-rift of the Japan Sea would be reopened at a greater depth in this section during repeatedly hitting the inflection point of the chain-saw downward process, until the inflection point is completely broken. Finally, when a shallow strong earthquake occurs near Korean Channel (southern end of the paleo-rift), the whole paleo-rift would have been completely resurrected, becoming a new subduction zone and underthrusting toward west into the Asian Continent, just like the Benioff Zone does. By that time, the whole Japanese archipelago would be in real danger. This would be the real sinking of Japan (Figure 1).

Foreign professor's reply letter of my prediction paper

According to the above mentioned facts and hypothesis, I made a medium-term prediction and stated clearly as follows: "in the paleo-rift of the Japan Sea, a shallow strong shock with focal depth of 30 km., magnitude more than 7 and tsunami will occur before 1993. Its epicenter will be in the central part of Japan Sea". The range of the epicenter of the coming earthquake was shown in Figure 2.

On October 1983, I sent my paper titled as "Forecast of Shallow Strong Earthquake in the Central Sea of Japan" respectively to Professor Robert S. Dietz at the Arizona State University USA and Professor R. C. Searle and Dr. Girdler at

the Institute of Oceanographic Sciences UK, and then all received their reply.



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Nov 18 83

Dr Sun Tian xi
Suzhoa , China PRC

Dear Dr Sun:

Your ms has reached me by a circuitous route as I am no longer with NOAA.

I cannot commen properly on your paper as I am not a seismologist or even a geophysicist but a marine geologist. I also have no direct connection with any scientific journal. Hence I return the ms to you at this time.

Publications in seismology in the USA are generally published in the Amer. Geophysical Union journal or the Bull. of the Seismological Society of American. I suggest you consult the editor of such a journal.

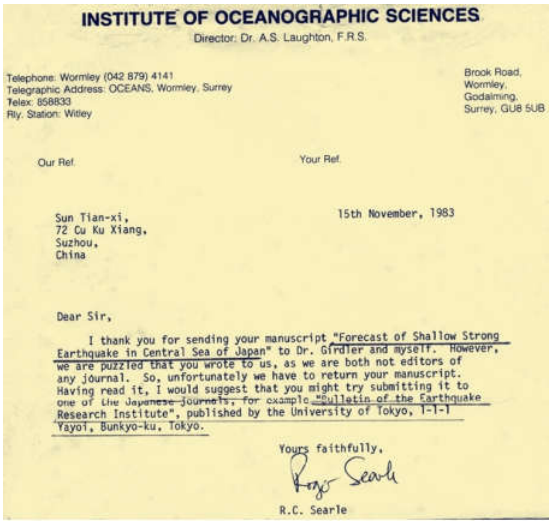
On the other hand I don't think your paper is in the proper form nor about a subject of great interest to an American journal. Hence I suppose that you paper would also certainly be found not acceptable to an American journal.

May I suggest therefore that you contact a Japanese organization such as the Earthquake Research Inst. in Tokyo. It should be of much interest to them.

Sincerely,

Robert S. Dietz
Prof. of Geology

Figure 3 A reply letter from Prof. R. S. Dietz



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Brook Road,
Wormley,
Godalming,
Surrey, GU8 5UB

Our Ref. Your Ref.

15th November, 1983

Sun Tian-xi,
72 Cu Ku Xiang,
Suzhou,
China

Dear Sir,

I thank you for sending your manuscript "Forecast of Shallow Strong Earthquake in Central Sea of Japan" to Dr. Girdler and myself. However, we are puzzled that you wrote to us, as we are both not editors of any journal. So, unfortunately we have to return your manuscript. Having read it, I would suggest that you might try submitting it to one of the Japanese journals, for example "Bulletin of the Earthquake Research Institute", published by the University of Tokyo, 1-1-1 Yayoi, Bunkyo-ku, Tokyo.

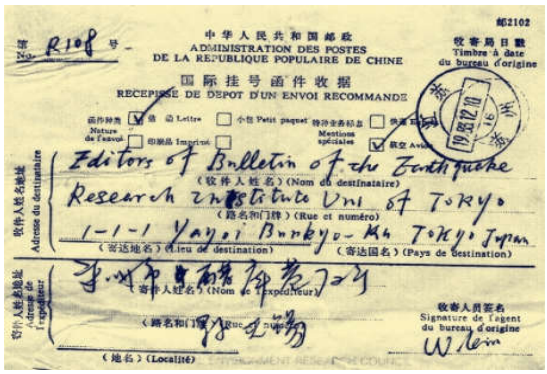
Yours faithfully,

R.C. Searle

Figure 4 A reply letter from Prof. R. C. Searle

An international registered mail receipt of the prediction paper sent to Earthquake Research Institute of Tokyo University

Professor Robert S. Dietz and Professor R. C. Searle all suggested me sent my this prediction paper to Earthquake Research Institute of Tokyo University. So, I then sent my this prediction paper to there by registered mail on 10 December 1983.



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ADMINISTRATION DES POSTES
DE LA REPUBLIQUE POPULAIRE DE CHINE

国际挂号函件收据
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Timbre à date du bureau d'origine

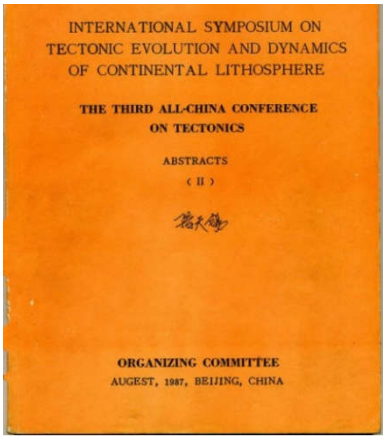
Editors of Bulletin of the Earthquake
Research Institute Uni of Tokyo.
1-1-1 Yayoi Bunkyo-Ku Tokyo Japan

Signature de l'agent du bureau d'origine

Figure 5 An International Registered Mail Receipt

Six years before the earthquake occurred, I attended an International Symposium and read out my prediction paper

In August 1987, I attended International Symposium on Tectonic Evolution and Dynamics of Continental Lithosphere held in Beijing, and read out my paper titled as "Forecast of Shallow Strong Earthquake in the Central Japan Sea", which was written into its collection of the theses. (Please see the scanning copies as Figure 6-7) (Sun, 1987).



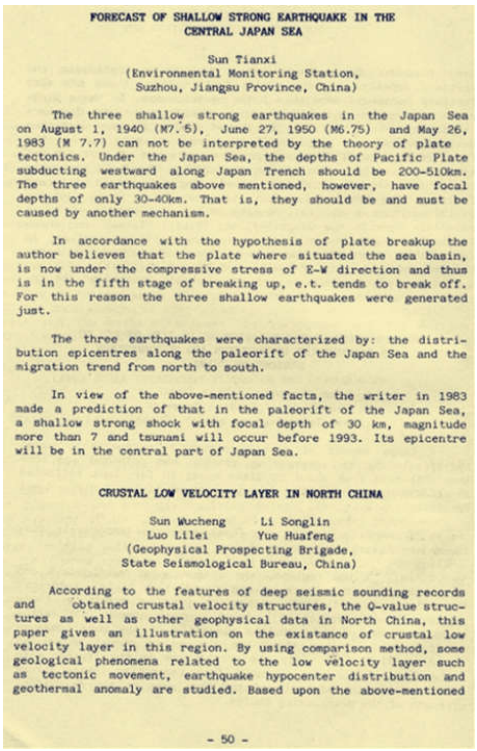
INTERNATIONAL SYMPOSIUM ON
TECTONIC EVOLUTION AND DYNAMICS
OF CONTINENTAL LITHOSPHERE

THE THIRD ALL-CHINA CONFERENCE
ON TECTONICS

ABSTRACTS
(II)

ORGANIZING COMMITTEE
AUGEST, 1987, BEIJING, CHINA

Figure 6 Front cover of the colloquium of thesis



FORECAST OF SHALLOW STRONG EARTHQUAKE IN THE CENTRAL JAPAN SEA

Sun Tianxi
(Environmental Monitoring Station,
Suzhou, Jiangsu Province, China)

The three shallow strong earthquakes in the Japan Sea on August 1, 1940 (M7.5), June 27, 1950 (M6.75) and May 26, 1983 (M 7.7) can not be interpreted by the theory of plate tectonics. Under the Japan Sea, the depths of Pacific Plate subducting westward along Japan Trench should be 200-510km. The three earthquakes above mentioned, however, have focal depths of only 30-40km. That is, they should be and must be caused by another mechanism.

In accordance with the hypothesis of plate breakup the author believes that the plate where situated the sea basin, is now under the compressive stress of E-W direction and thus is in the fifth stage of breaking up, e.t. tends to break off. For this reason the three shallow earthquakes were generated just.

The three earthquakes were characterized by: the distribution epicentres along the paleorift of the Japan Sea and the migration trend from north to south.

In view of the above-mentioned facts, the writer in 1983 made a prediction of that in the paleorift of the Japan Sea, a shallow strong shock with focal depth of 30 km, magnitude more than 7 and tsunami will occur before 1993. Its epicentre will be in the central part of Japan Sea.

CRUSTAL LOW VELOCITY LAYER IN NORTH CHINA

Sun Wucheng Li Songlin
Luo Lilei Yue Huafeng
(Geophysical Prospecting Brigade,
State Seismological Bureau, China)

According to the features of deep seismic sounding records and obtained crustal velocity structures, the Q-value structures as well as other geophysical data in North China, this paper gives an illustration on the existance of crustal low velocity layer in this region. By using comparison method, some geological phenomena related to the low velocity layer such as tectonic movement, earthquake hypocenter distribution and geothermal anomaly are studied. Based upon the above-mentioned

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Figure 7 Abstract of my paper

The writer's medium-term prediction basically came true

An Off Noto Peninsula earthquake of M6.6 occurred under the Central Japan Sea (37.39°N, 137.17°E) on 7th Feb. 1993 with focal depth of 29km and a small tsunami (Tsukuda *et al*., 1994; Kuniaki and Masami, 1995; Japan Meteorological Agency, 1993) demonstrated that the writer's medium-term prediction basically came true, although over 38 days (see Table 2).

In 1994, one of the Japanese authoritative academic journals, Journal of the Geodetic Society of Japan, published my paper entitled as *Medium-Term Prediction of Off Noto Earthquake of 7th Feb. 1993* (Sun, 1994), thus confirming my this prediction.

The success of the prediction based on the model of plate breakup and migration pattern of large shallow earthquakes under the Japan Sea should provide an impetus to similar investigation elsewhere.

CONCLUSIONS

Earthquake prediction might be still very difficult so far in the world. Successful medium-term earthquake predictions such as can accurately predict the earthquake's four elements (origin time, epicenter, magnitude and focal depth), were few and far between. My prediction about the strong shallow earthquake under Japan Sea might belong to this kind, although its origin time is over 38 days. It must be pointed out that, except myself, there was no one can yet predict the focal depth. Moreover, the process of my this earthquake prediction was very rigorous, and its evidences might be unimpugnable.

Now, let's compare with other two medium-term predictions above mentioned as follows (see Table 2):

Table 2 Comparison among the Three Medium-Term Predictions

		Earthquake between India and Burma	Parker Field Earthquake (USA)	Off Noto Earthquake (Japan)
Who predicted the earthquake		Professor H. K. Gupta	Professor Thomas McEvilly, *et al*.	Professorial Senior Engineer Tianxi Sun
When to make the prediction		1986	1985	1983
Origin Time	Predict	Before 1990	Before 1993	Before 1993
	In fact	6 August 1988	28 September 2004	7 February 1993 (Tsukuda *et al*., 1994) (over 38 days)
Epicenter	Predict	20~26° N 92~98° E	Parker Field California, USA	37~39° N 135~138° E
	In fact	25° N 95° E	Parker Field California, USA	37.64° N 137.31° E around a sea rise (Tsukuda *et al*., 1994)
Magnitude	Predict	6.1	5.5-6.0	more than 7.0
	In fact	7.5	6.0	6.6 (Tsukuda *et al*., 1994)
Focal Depth	Predict	/	/	30 km
	In fact	/	/	29 km (Japan Meteorological Agency, 1993). or 14.9km (Tsukuda *et al*., 1994)
Tsunami	Predict	/	/	tsunami
	In fact	/	/	small tsunami (Kuniaki and Masami, 1995

This paper emphasized the rigorous of the prediction process and the solid of its evidences which were first-time published. As prediction itself, my medium-term earthquake prediction should be basically full and accurate: based on a lot of parameters of focal mechanism among 530 destructive earthquakes occurred in Far East Asia during the period from 1933 to 1964 (Aver'yanova, 1973); established a mechanical model; foreign professor's reply letters of my prediction paper; an international registered mail receipt of the prediction paper sent to Earthquake Research Institute of Tokyo University; six years before the earthquake occurred, I attended International Symposium on Tectonic Evolution and Dynamics of Continental Lithosphere held in Beijing, and in this meeting I read out my paper titled as "Forecast of Shallow Strong Earthquake in the Central Japan Sea", which was written into its collection of the theses.

The earthquake I predicted came in, although over 38 days. Other the fours were all basically correspondent with my prediction: its epicenter, its magnitude, its focal depth and even its tsunami (see Table 2).

After this earthquake, Journal of the Geodetic Society of Japan published my paper entitled as *Medium-Term Prediction of Off Noto Earthquake of 7th Feb. 1993,* thus confirming my this prediction.

Therefore, my this medium-term prediction achieved success and received extensive coverage of the news media (Chen, 1993; Gu, 1993; Mi, 1993; Gu, 1994). The success of the prediction based on the model of plate breakup and migration pattern of large shallow earthquakes under the Japan Sea should provide an impetus to similar investigation elsewhere.

The success of this prediction might fill a blank of earthquake prediction. The paper is good example of an earthquake being successfully predicted in terms of where, when and how big even focal depth and tsunami.

The successful prediction was confirmation of the paleo-rift re-breaked model under Japan Sea. I am deeply worried about the geological future of the Japanese archipelago.

Declaration of Interests

The author declares no competing interests.

Acknowledgment

I would like to thank Prof. Hiroshi Sato of Japan Hirosaki University for his valuable advice and much encourages.

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