The September – October 2016 Korea and Southwest Japan earthquakes viewed from the Blot's thermal energy transmigration concept

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Abstract: The two strong earthquakes that hit Korea and Japan in September and October 2016, respectively, were analysed by the energy transmigration (ET) concept (or ET law) established by Claude Blot in 1976. The results convincingly show that the energy of both quakes was sourced from the two deep strong quakes (M5.8 &6.3; H=563 km) in April 2013 three and half years earlier in Russian Far East. This indisputable evidence proves that, 1) deep Earth-sourced energy is crucial in understanding the process of shallow earthquake generation, 2) the ET concept is one of the most powerful long to medium-term prediction tools, and 3) the widely claimed plate subduction as the cause of earthquakes in the Pacific margins cannot be supported. Given the facts that the Earth has entered the Earth core active phase in relation to the arrival of a major solar low cycle and a recent rapid increase in devastating earthquakes worldwide, a right understanding of earthquake generation mechanism which benefits prediction is urgently required.

Keywords: *the September 2016 Gyeongju Korea earthquake, the October 2016 Kurayoshi Japan earthquake, thermal energy transmigration concept, deep precursory earthquake, increased Earth's outer core activity*

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1. Introduction

In late 2016 (September to October) two strong earthquakes hit Gyeongju, southernmost Korea and Kurayoshi, southwestern Japan (**Fig. 1**). Their detailed parameters are as follows (**Table 1**):

Table 1. Two strong earthquakes in Korea and Japan, 2016 studied in this article.

Date	Latitude	Longitude	Depth (km)	Magnitude
Korea quake				
2016-09-12	35.7808	129.2162	13	5.4
Japan quake				
2016-10-21	35.3579	133.8013	10	6.2

These two quakes came to the author's attention because his preliminary analysis indicated that they occurred in accordance to the well-established Blot's energy transmigration concept (or ET concept or law; Blot, 1976; Grover, 1998). The essence of this article has been circulated among IEVPC associates and other colleagues a few days after the October 2016 Japan quake. It indisputably proves that the energy of these quakes has come from the deep-Earth under the Russian Far East, and that it has important implications in understanding earthquakes and tectonic processes in the island arcs in the western Pacific. This article details these discoveries for wider audience.

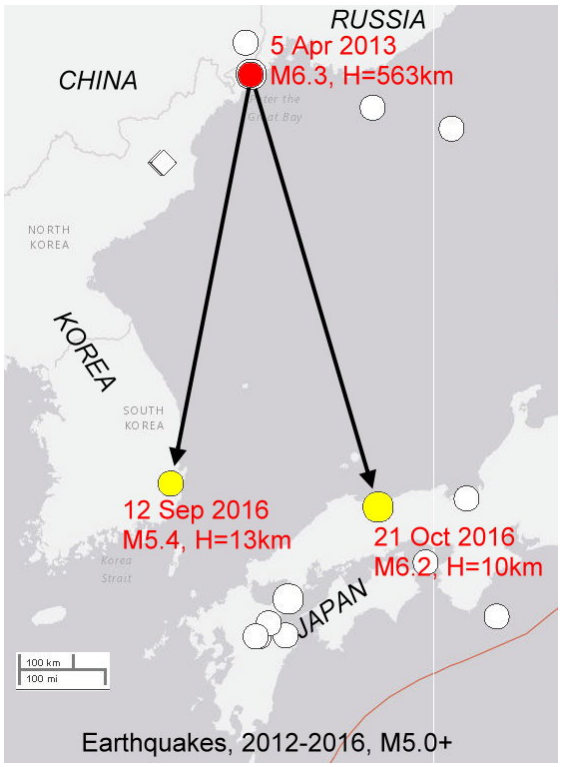

Figure 1. Strong (M5.0+) earthquakes in Korea, Japan and Russian Far East from 2012 to 2016. The quakes discussed in this paper are highlighted.

2. Korea and Southwest Japan earthquakes in late 2016

1) Korea

The Korean quake in September was originally assigned to 5.9 magnitude, but later downgraded to 5.4. It was preceded by a 5.1 magnitude quake 45 minutes earlier. This quake was most powerful in Korea since seismic records were first collated on the peninsula in 1978. Although there were no fatalities, some buildings and historic cultural assets in Gyeongju which had withstood intact for over 1,000 years, were damaged. Korean seismologists attributed this quake to the seismic activity that rattled Japan in the last six years, while others blamed plate subduction as the cause of this earthquake. (http://www.thejakartapost.com/life/2016/09/19/artifacts-damaged-in-record-breaking-earthquake-in-gyeongju.html; http://www.telegraph.co.uk/news/2016/09/13/warning-that-korean-peninsula-could-become-new-quake-zone-after/; and others).

2) Southwest Japan

A more powerful quake with magnitude 6.2 followed 39 days after the Korean quake in Kurayoshi, a town on the Sea of Japan coast (**Fig. 1**).

Japan Meteorological Agency gave the magnitude 6.6 and the epicenter depth 11 km, whereas USGS 6.2 and 10 km, respectively (http://www.usnews.com/news/news/articles/2016-10-21/powerful-earthquake-in-western-japan-no-danger-of-tsunami). Property damage, power outage and some injuries occurred.

It must be noted that Hong-Chun Wu of Taiwan found a jetstream anomaly appeared one day before the quake, at 0600 UTC of 20 October 2016 near the hypocenter. He posted this information on his website on 21 October 2016, on the same day as the quake occurred: https://www.facebook.com/photo.php?fbid=1232773063441407&set=a.657516484300404.1073741826.100001261760990&type=3&theater).

3. Energy transmigration (ET) analysis

Claude Blot established the thermal energy transmigration concept 40 years ago (1976) in a French journal, which was introduced by Grover (1998) in English. The ET concept or ET law can link deep and shallow earthquakes/volcanic eruptions. The author had chances to work with Blot which resulted in many joint papers in relating deep and shallow quakes(Blot and Choi, 2004 and 2005 for example).

Today the thermal energy transmigration concept has been firmly established on sound scientific grounds. It is of special significance because the concept allows predicting catastrophic shallow earthquakes several years in advance. As described below, this study is another validation of the ET concept, which, unfortunately, has been totally neglected by mainstream seismological authorities.

The author searched possible precursor deep quakes for the September-October 2016 Korea and Japan shallow quakes. The strong quakes with magnitude 5.0 or greater, in the Korea, Japan and Far East Russian regions, were extracted from the USGS archives and listed and plotted in **Table 2 and Fig 1.**

Table 2. Strong earthquakes, M5.0 or greater, from 2012 to 2012 in Korea-Japan-Far East Russia listed on the USGS NEIC webpages. Rows highlighted in orange are deep quakes which are linked to the shallow Korea and Japanese quakes in yellow.

time	latitude	longitude	depth	mag	mag Type
2016-10-21T05:07:23.620Z	35.3579	133.8013	10	6.2	mww
2016-09-12T11:32:55.770Z	35.7808	129.2162	13	5.4	mww
2016-09-09T00:30:01.440Z	41.2869	129.0783	0	5.3	mb
2016-04-18T11:42:00.220Z	33.0143	131.0991	10.46	5.5	mww
2016-04-15T22:11:40.270Z	33.2528	131.3738	10	5.1	mwr
2016-04-15T18:55:53.500Z	33.0051	131.1569	13.22	5.5	mwr
2016-04-01T02:39:08.050Z	33.3807	136.3901	14	5.9	mww
2016-01-06T01:30:01.480Z	41.2996	129.0467	0	5.1	mb
2015-07-12T17:52:06.170Z	33.0229	131.7493	53	5.5	mww
2015-05-25T06:37:40.890Z	41.8504	135.3922	385.81	5.1	mb
2014-12-05T16:01:56.830Z	35.5141	135.7189	355.12	5	mb
2014-03-13T17:06:50.770Z	33.6842	131.8249	79	6.3	mww
2013-10-29T20:17:50.710Z	43.2375	130.8797	554.28	5.1	mb
2013-09-02T02:51:13.230Z	42.1989	133.6656	445	5.7	mww
2013-04-12T20:33:17.540Z	34.369	134.828	14	5.8	mww
2013-04-06T00:29:55.090Z	42.726	130.976	562.8	5.8	mww
2013-04-05T13:00:02.130Z	42.736	131.003	563.3	6.3	mww
2013-02-12T02:57:51.490Z	41.299	129.004	0	5.1	mb

The parameters of relevant earthquakes are now plotted on the ET analysis graph, **Fig. 2**.

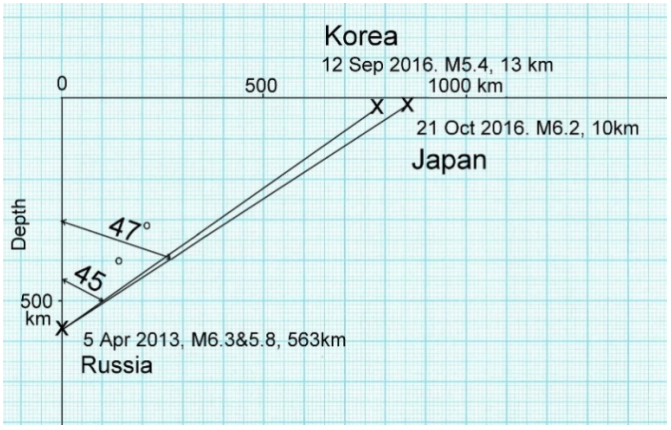

Figure 2. ET analysis graph. Earth surface is weakly warped, but is neglected in this figure because it is minor and does not affect the angle α. Distance from the deep forerunners and the shallow quakes were derived from a map generated on the IRIS webpage (http://ds.iris.edu/seismon/).

Here the Blot's ET formula is:
Days (time delay from deep to shallow quakes) = constant (525) x log (deep shock depth/shallow depth) x 1/cosα

In this formula, the depth of occurrence of shallow shock affects largely on the outcome or predicted date; even 1 to 2 km difference results in several months in difference.

1) Korea
Parameters used for the Korean quake: log (563/13) x1/cos45. Deep shock date, 5 Apr 2013.

Result of calculation: Days, 1215days = 2 August 2016. Actual occurrence12 September, which is 41 days later than the calculated result.

2) Japan
The ET formula input parameters: log (563/10) x1/cos46. Deep shock date, 5 April2013.

Result: Days, 1323days=17 November 2016, which is 27 days later than the actual occurrence. If the input depth is 11km, which is the Japan Meteorological Agency-determined depth, the date becomes 17 October 2016, which is 4 days earlier in deviation.

To summarize the above:

Locality	**ET calculation (prediction)**	**Actual day of event**	**Deviation**
Korea quake	2 August 2016 (depth 13 km)	12 September 2016	41 days earlier
Japan quake	17 November 2016 (depth 10 km) 17 October 2016 (depth 11 km)	21 October 2016	27 days later 4 days earlier

4. Discussion

As described in the foregoing pages, the ET law's predicted dates for both quakes almost perfectly matched the actual events. This fact proves the energy link between the deep quakes in Far East Russia in 2013 and the shallow quakes in Korea and Japan in 2016. The time delay is about 3 years and half.

On the other hand, the present exercise demonstrates the crucial role of deep energy in causing shallow earthquakes. We have repeatedly shown this fact in many studies of great earthquakes; the 2004 Niigata Chuets Earthquake (Blot and Choi, 2004), the 2005 Kashmir Earthquake (Blot and Choi, 2005), the 2011 Great East Japan Earthquake (Choi, 2011), the 2015 Coquimbo Chile Earthquake (Choi and Casey, 2015), and the 2016 Kumamoto Earthquake (Tsunoda and Choi, 2016), to name only a few.

The thermal energy flow from deep to shallow Earth as a main cause of tectonic processes including earthquakes and volcanic eruptions flatly negates the plate subduction widely believed by mainstream seismic authorities in the last 50 years. The former has significant implications in understanding geodynamic processes of the Earth, particularly those occurring in the western Pacific margins, and most importantly it opens the way to accurately predict great earthquakes. Recent continuing successful predictions based on a multiparameter approach by a group represented by IEVPC and other colleagues eloquently testifies to this (Coquimbo earthquake in 1995, *NCGT Journal*, v. 3, no. 3; Kumamoto earthquake, *NCGT Journal*, v. 4, no. 2; and others).

Although the IEVPC had not announced the prediction of the two quakes in concern for various reasons, if we had performed the ET analysis in advance in combination with the jetstream anomaly and organized a team for detecting early precursory signals, the Korean and Japanese quakes would have been successfully predicted.

In general, the energy from deep to shallow Earth flows along thrust fault zones (Wadati-Benioff zone), developed at the periphery of the Western Pacific. In some cases, the energy flow occurred along major

deep fault zones in addition to the flow along the Wadati-Benioff zone, as seen in the case of 2011 Great East Japan Earthquake (Choi, 2011). However, in many cases, the energy flow paths show a complex pattern, mainly controlled by deep fault zones which takes mostly an orthogonal pattern. Therefore, a good knowledge of deep structure around the epicenter of strong deep quakes is essential to correctly predict the direction of energy transmigration. The importance of major structural trend must be further emphasized here, because after reaching the shallow Earth the energy becomes trapped in the structural highs bounded by deep faults where the final energy release takes place.

The ET concept is applicable for the Wadati-Benioff zone quakes, the present Korea and Japan quakes being two examples. For distant lateral shallow energy transmigration under the tectonic mobile belts (a concept originally proposed by surge tectonics, Meyerhoff et al., 1996), however, the ET concept cannot be applied. The shallow energy movement under tectonic belts can be detected by tracing the occurrence of strong earthquakes (usually M6.5 or greater) and volcanic activities, which was coined as VE process by Tsunoda (2009). A good example of this long lateral energy movement is seen in the April 2016 Kumamoto earthquake (Tsunoda and Choi, 2016). The author analysed seismic energy movement by tracing great earthquakes in the Pacific coasts of North and South Americas (Choi, 2014a and 2014b).

5. Conclusions

1) This study identified precursory deep earthquakes in the Far East Russia for the strong Korean and Japanese earthquakes occurred in late 2016.
2) The precursory deep quake occurred in April 2013, about three and half years earlier with similar magnitude.
3) The present paper provides an additional support for the ET concept. The concept is a powerful long to medium-term prediction tool.
4) The ET concept is of particular importance in considering the geodynamic processes of the Earth, particularly the island arc formation in the Western Pacific. It rejects the application of plate subduction model to the island arcs in the Western Pacific.

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