Tunguska explosion revisited.

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Abstract. In this paper we discuss the previously unnoticed connection of the Tunguska explosion to natural events decades or even centuries long: 1) the third geomagnetic maximum appeared not too far from the epicenter of the Tunguska explosion in the 19th century and has been moving towards the epicenter of the Tunguska explosion along a straight line since 1908; 2) the magnetic North Pole is moving along the path leading to the epicenter of the Tunguska explosion, 3) all magnitude $\geqslant 7.6$ earthquakes sufficiently far from the ocean form an arrow pointing towards the epicenter of the Tunguska explosion; 4) the Tunguska explosion occurred at the end of the twisted portion in the path of the magnetic North Pole and at the time when magnitude $\geqslant 8.2$ earthquakes and VEI $\geqslant 5$ volcanic eruptions recovered correlation with syzygies.

Key words: Tunguska explosion.

> The greatest obstacle to knowledge is not ignorance,
> it's the illusion of knowledge. Author unknown.

It has been 110 years since the June 30, 1908 explosion at $60.917^oN, 101.95^oE$ by the river of Podkamenaya Tunguska. Numerous theories have been proposed, numerous papers have been written, numerous expeditions have been dispatched to study the site of the explosion leaving no stone unturned. What else could be left there to talk about? It turns out the past 110 years provided us with new possible clues to the puzzle, we discuss them here. The discussion renders support to the terrestrial origin of the Tunguska explosion, [5, 8]; the material discussed in the aforementioned references is not repeated hear.

Emergence of a new geomagnetic maximum. Figure 1 shows snapshots of the Earth's magnetic field in 1750 - 2000. In 1750 - 1850 there were two maxima of the total intensity of the Earth's magnetic field: one near Antarctica and one in North America. A third geomagnetic maximum appeared by 1900 not too far from the epicenter of the Tunguska explosion, it is pointed to by an arrow in frame '1900'. However, the data in [4] indicates that the third geomagnetic maximum appeared around 1820 - 1830, it was simply not large enough to show in Figure 1 earlier.

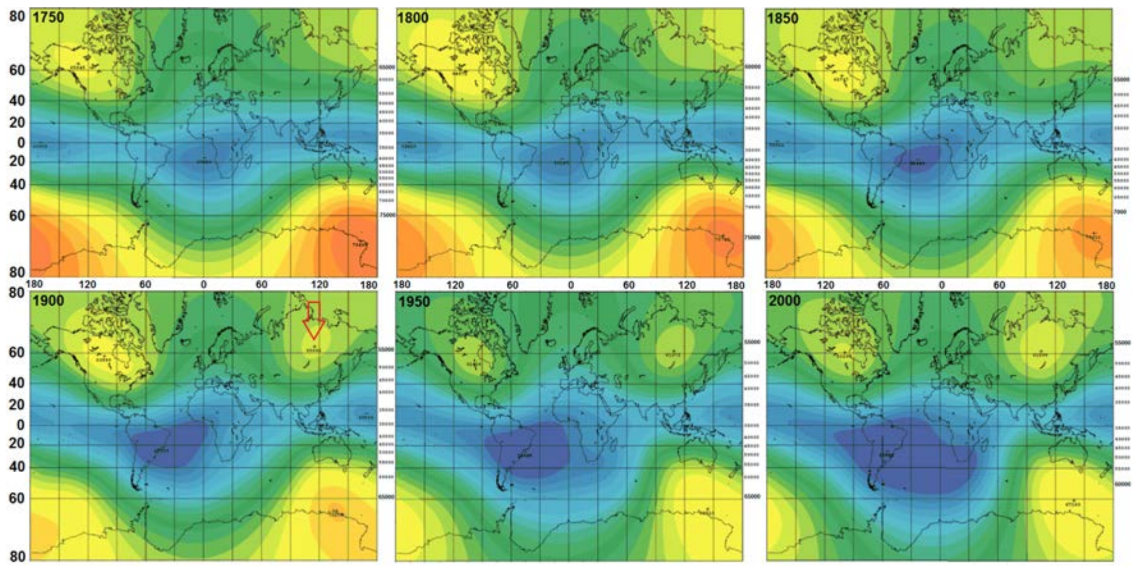

Figure 1: Total intensity of the Earth's magnetic field in nT for 1750 - 2000 in IGRF model, [2].

The appearance of the third geomagnetic maximum was preceded by 1) a no-more-than-several-decades-long drastic increase of the North American geomagnetic maximum, the yellow spot in North America in frame '1800' is much larger than in frames '1750' and '1850'; 2) numerous powerful geomagnetic storms in 1781-1789, [10]; 3) enigmatic May 19, 1780 Dark Day in New England, fairly close to the North American geomagnetic maximum. Since its appearance, the third geomagnetic maximum has been moving towards the epicenter of the Tunguska explosion, its location on 1908/6/30, according to IGRF, was $\approx 63.8^oN, 110.65^oE$, or $\approx 550\ km$ from the epicenter of the Tunguska explosion. IGRF placed the third geomagnetic maximum on 2017/12/6 at $\approx 61.5^oN, 103.15^oE$, while WMM placed it at $\approx 61.4^oN, 103.85^oE$; we take the average $\approx 61.45^oN, 103.5^oE$ of the two as the true location, it is merely $\approx 101\ km$ away from the epicenter of the Tunguska explosion, [4]. Such close proximity can hardly be coincidental. As Figure 2 shows, the epicenter of the Tunguska explosion and the locations of the third geomagnetic maximum on 1908/6/30 and 2017/12/6 are almost on the same line; of course, the third geomagnetic maximum does not move strictly along a straight line but close to it. As the geomagnetic maximum approaches the epicenter of the Tunguska explosion, it slows down; all things considered,

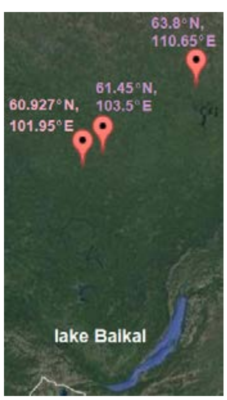

Figure 2: Location of the third geomagnetic maximum on 1908/6/30 and 2017/12/6 and Tunguska explosion, [4, 13].

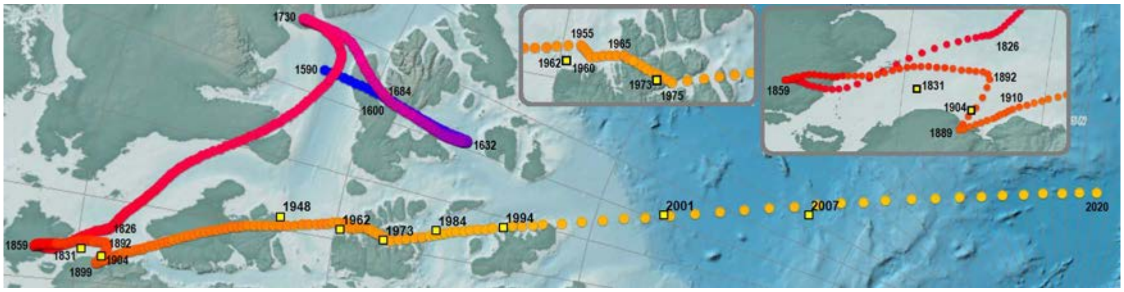

Figure 3: Modelled path of the magnetic North Pole, [6]. Yellow squares indicate observed locations which do not necessarily coincide with modelled locations. The gUFM model was used for 1590-1890, the IGRF model was used for 1900-2020, a smooth transition was imposed for 1890-1900 to connect the models.

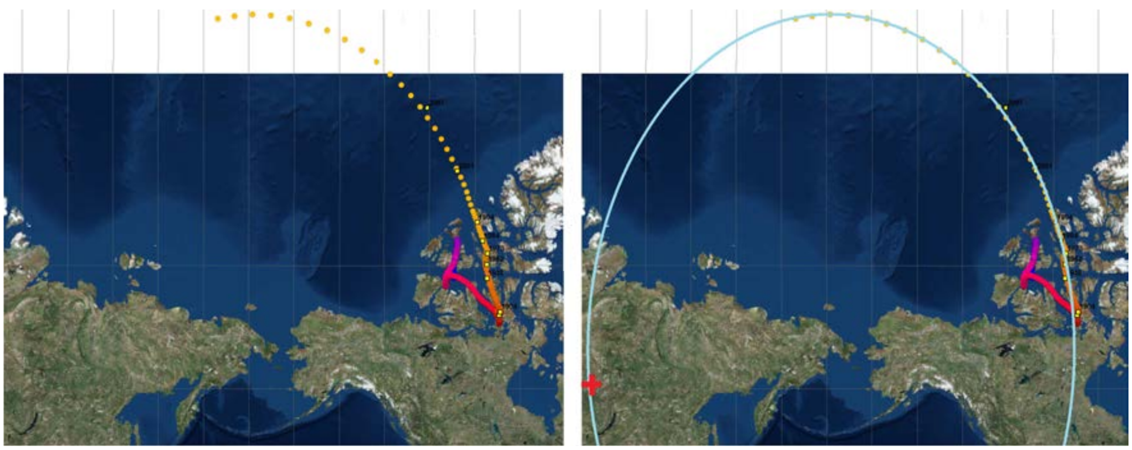

Figure 4: The path of the magnetic North Pole from Figure 3 in the Mercator projection, [6]. The magnetic North Pole follows the elliptic path shown in light blue; if it stays on the same path, it will eventually reach the epicenter of the Tunguska explosion marked by the red cross.

it should reach the epicenter of the Tunguska explosion in $\approx 100 - 150$ years.

Motion of the magnetic North Pole. Figure 3 shows the path of the magnetic North Pole from 1590 to 2017. In 1826, about the same time as the third geomagnetic maximum started forming, the magnetic North pole went on a wild ride that lasted until about 1910 and included sharp turns around 1859, 1892, and 1899. The wild ride of 1826 - 1910 was preceded by the Dalton minimum of $\approx$ 1796 - 1928.

Figure 4 shows the path of the magnetic North Pole in the Mercator projection. Since about 1900 the path of the magnetic North Pole has been practically indistinguishable from an ellipse shown in blue. If the magnetic North Pole continues along the same path, in 100-150 years its location will be within kilometers of the epicenter of the Tunguska explosion.

Thus we me expect the third geomagnetic maximum and the magnetic North Pole reach the epicenter of the Tunguska explosion in ≈ 100 years. What we are witnessing here is the first step in the reversal of the Earth's magnetic polarity.

Intraplate seismic activity. The left frame of Figure 5 shows earthquakes of $M \geqslant 7.6$ in 1900 - 2017; almost all, shown in gray, struck in or close to water and at or close to tectonic lines. Only few, shown in yellow, struck far from water and off tectonic lines. The right frame zooms in on the latter with $M \geqslant 7.8$ earthquakes shown in pink and $M = 7.6, 7.7$ earthquakes shown in yellow; of the 16 $M \geqslant 7.6$ earthquakes, 12 struck in 1902 - 1937; and only 4 in 1938 - 2016. The location of the third geomagnetic maximum in 1908 and in 2017 is shown by the purple crosses; the epicenter of the Tunguska explosion is shown by the red cross. $M \geqslant 7.8$ earthquakes, marked pink, form an arrow pointing towards the epicenter of the Tunguska explosion and the geomagnetic maximum. It is very unlikely that the earthquakes were unrelated to the newly-born geomagnetic maximum. The earthquakes shown in Figure 6 concentrate along the Baikal Rift Zone. The earthquakes marked by yellow-green also form a triangle pointing towards the epicenter of the Tunguska explosion indicated by the red cross.

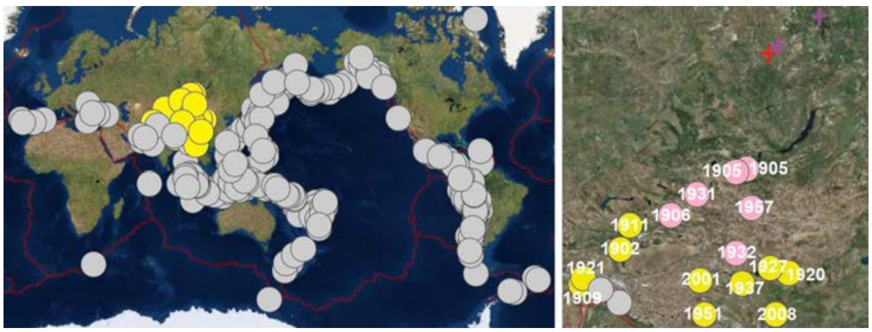

Figure 5: M $\geqslant$7.6 earthquakes southwest of the Tunguska explosion, [9, 13].

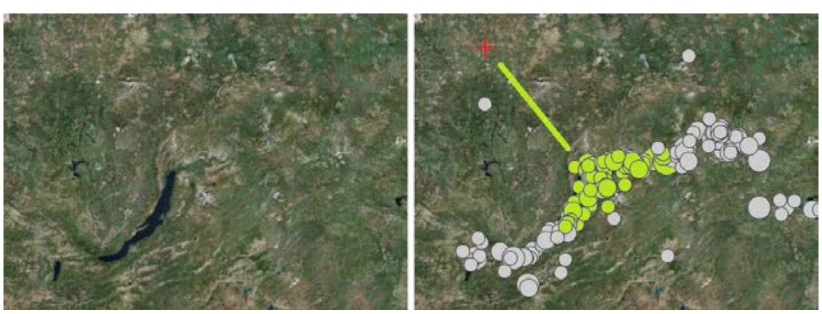

Figure 6: M $\geqslant$ 4.6 earthquakes with latitude from $50^{o}N$ to $70^{o}N$, and longitude from $100^{o}E$ to $130^{o}E$, [9].

Date, time, magnitude	pertinent celestial events	n
2017/9/8 4:49 M=8.2	2017/9/6 7:05 syzygy and 2017/9/7 X9.3 solar flare	2
2015/9/16 22:55 M=8.3	12 days before 2015/9/28 syzygy-perigee	0
2014/4/1 23:46 M=8.2	53 hours after 2014/3/30 18:48 syzygy	2
2013/5/24 5:45 M=8.3	23 hours before 2013/5/25 4:27 syzygy 30.3 days before 2013/6/23 11:34 syzygy-perigee	1
2012/4/11 8:39 M=8.6	25 days before 20012/5/6 syzygy-perigee	0
2011/3/11 5:46 M=9.1	7 days before 2011/3/18-19 syzygy-perigee	0
2010/2/27 6:34 M=8.8	2010/2/28 16:39 syzygy, 2010/2/27 perigee 28 days after 2010/1/30 syzygy-perigee	0
2007/9/12 11:10 M=8.4	22.5 hours after 2007/9/11 12:45 syzygy	1
2006/11/15 11:14 M=8.3		$\geqslant 4$
2005/3/28 16:10 M=8.6	67 hours after 2005/3/25 21:01 syzygy	3
2004/12/26 0:59 M=9.1	2004/12/26 21:31 syzygy, 2005/1/2 perihelion 15 days before 2005/1/10 syzygy-perigee	0
2003/9/25 19:50 M=8.3	7.5 hours before 2003/9/26 3:09 syzygy	0
2001/6/23 20:33 M=8.4	58.5 hours after 2001/6/21 11:59 syzygy	2
1996/2/17 6:00 M=8.2	41.5 hours before 1996/2/18 23:32 syzygy	2
1994/10/4 13:23 M=8.3	30 days before 1994/11/3 13:36 syzygy-perigee 14.5 hours before 1994/10/5 3:55 syzygy	0
1994/6/9 0:33 M=8.2	1994/6/9 8:28 syzygy	0
1989/5/23 10:55 M=8.2	65.5 hours after 1989/5/20 18:18 syzygy 48 days after 1989/4/5 syzygy-perigee	3
1977/8/19 6:09 M=8.3		$\geqslant 4$
1968/5/16 10:39 M=8.2	4 days after 1968/5/12 13:05 syzygy-perigee	0
1965/2/4 5:01 M=8.7	18 days after 1965/1/17 syzygy-perigee	0
1965/1/24 0:11 M=8.2	7 days after 1965/1/17 syzygy-perigee	0
1964/3/28 3:36 M=9.2	1964/3/28 2:49 syzygy	0
1963/10/13 5:18 M=8.5	20 days before 1963/11/2 syzygy-perigee	0
1960/5/22 19:11 M=9.5	1960/5/25 12:27 syzygy 19 days before 1960/6/9 syzygy, 1960/6/10 perigee	3
1958/11/6 22:58 M=8.3	24 days after 1958/10/13 syzygy-perigee	0
1957/3/9 M=8.6	23 days after 1957/2/14 syzygy-perigee	0
1952/11/4 16:58 M=9.0	64 hours after 1952/11/1 23:09 syzygy	3
1950/12/9 21:39 M=8.2	1950/12/9 syzygy-perigee	0
1950/8/15 14:10 M=8.6	46 hours after 1950/8/13 16:47 syzygy	2
1949/8/22 4:01 M=8.2	48 hours before 1949/8/24 3:59 syzygy, 1949/8/25 perigee	2
1946/12/20 19:19 M=8.3	11 days after 1946/12/9 syzygy-perigee	0
1946/4/1 12:29 M=8.6	16 hours before 1946/4/2 4:39 syzygy	1
1940/5/24 16:34 M=8.2	75 hours after 1940/5/21 13:32 syzygy	3
1938/11/20 20:19 M=8.3	28 hours before 1938/11/22 0:05 syzygy	1
1938/2/1 19:04 M=8.5	29.5 hours after 1938/1/31 13:35 syzygy	1

Table 1: M $\geqslant$ 8.2 earthquakes in 1938 - 2017 and their correlation with syzygies, [9, 12]. If $n = 3, 2, 1, 0$, then the earthquake struck either within $12 + 24n$ hours of a syzygy or within $30 + n$ days of a syzygy-perigee. Since the synodic month is ≈ 29.5 days, any event is no more than 7-8 days away from the nearest syzygy, hence only $n = 3, 2, 1, 0$ are considered.

Date, time, magnitude	pertinent celestial events	n
1933/3/2 17:31 M=8.4		$\geqslant 4$
1923/2/3 16:02 M=8.4	48 hours after 1923/2/1 15:54 syzygy	2
1922/11/11 4:33 M=8.5		$\geqslant 4$
1920/12/16 12:06 M=8.3	10 days before 1920/12/26 syzygy-perigee	0
1920/6/5 4:22 M=8.2	11 days before 1920/6/16 syzygy-perigee	0
1918/8/15 12:18 M=8.3		$\geqslant 4$
1917/5/1 18:26 M=8.2		$\geqslant 4$
1906/8/17 0:40 M=8.2 in Chile	73 hours before 1906/8/20 1:26 syzygy	3
1906/8/17 0:11 M=8.3 in Alaska	74 hours before 1906/8/20 1:26 syzygy	3
1906/1/31 15:36 M=8.8		$\geqslant 4$
1905/7/23 2:46 M=8.3		$\geqslant 4$
1905/7/9 9:41 M=8.3		$\geqslant 4$

Table 2: M $\geqslant$ 8.2 earthquakes in 1900 - 1933, [9, 12]. If $n = 3, 2, 1, 0$ then the earthquake struck either within $12 + 24n$ hours of a syzygy or within $30 + n$ days of a syzygy-perigee.

Date, time, magnitude	pertinent celestial events	n
1897/6/12 M=8.3	1897/5/16 syzygy-perigee	0
1896/6/15 10:32 M=8.8	1896/6/11 8:42 syzygy , 14 hours short of $n = 3$	$\geqslant 4$
1877/5/10 0:59 M=8.5	1877/5/13 5:30 syzygy	3
1868/8/13 M=8.5-9.0	1868/8/17-18 syzygy-perigee	0
1861/2/16 M=8.5	1861/3/26 syzygy-perigee, 8 days short of $n = 3$	$\geqslant 4$
1854/12/23-24 two adjacent M=8.4 earthquakes	1855/1/18 syzygy-perigee	0
1835/2/20 M=8.5		$\geqslant 4$
1833/11/25 M=8.8	1833/11/27 7:09 syzygy	2
1822/11/19 M=8.5	1822/11/29 syzygy-perigee, 1822/11/13 syzygy	0
1797/2/10 M=8.4	1797/1/12 syzygy-perigee, 1797/2/11 syzygy	0
1787/3/28 M=8.6	powerful geomagnetic storms in 1781-1789, [10]	$\geqslant 4$
1762/4/2 M=8.8		$\geqslant 4$
1755/11/1 M=8.5-9.0	1755/11/4 syzygy-perigee	0
1751/5/24 M=8.5	1751/4/25-26 syzygy-perigee, 1751/5/25 syzygy	0
1746/10/28 M=8.6	1746/11/12 syzygy-perigee, 1746/10/29 syzygy	0
1737/10/17 M=8.5	1737/10/23 syzygy-perigee	0
1730/7/8 M=8.7	1730/6/30 syzygy-perigee	0
1707/10/28 5:00 M=8.7-9.3	1707/10/25 14:33 syzygy	3
1703/12/31 M=8.2	1704/1/6 syzygy-perigee	0
1700/1/26 M=8.7-9.2	1700/1/5 syzygy-perigee	0
1687/10/20 M=8.5	1687/10/20 syzygy	0
1647/5/14 M=8.5	1647/5/18 syzygy, beginning of Maunder Minimum	$\geqslant 4$
1604/11/24 M=8.5	1604/10/22 syzygy-perigee	3
1575/12/16 M=8.5	1575/12/18 syzygy-perigee	0

Table 3: Known M $\geqslant$ 8.2 earthquakes in 1687 - 1899, [12, 15]. If $n = 3, 2, 1, 0$ then the earthquake struck either within $12 + 24n$ hours of a syzygy or within $30 + n$ days of a syzygy-perigee. One should keep in mind that [12] loses its precision as we go back in time.

Correlation of earthquakes with syzygies. Table 1 shows all $M \geqslant 8.2$ earthquakes in 1934-2017. The number of earthquakes within $12 + 24n$ hours of a syzygy or within $30 + n$ days of a syzygy-perigee[1] for $n = 3/2/1/0$ is 33/29/23/18, or 94.3%/82.9%/65.7%/51.4%, of the total of 35. If the earthquakes were distributed randomly relative to syzygies, the distribution would have been 63%/53.3%/43.6%/33.9% due to formula

$$\begin{array}{l}\text{the proportion of days within } 12+24n \text{ hours of a syzygy,}\\ \text{or within } (30+n) \text{ days of a syzygy-perigee, 1 day } = 24 \text{ hours}\end{array} \approx \frac{140+40n}{413} \tag{1}$$

Remarkably, the ratios $\dfrac{94.3}{63} \approx 1.5$, $\dfrac{82.9}{53.3} \approx 1.56$, $\dfrac{65.7}{43.6} \approx 1.51$, $\dfrac{51.4}{33.9} \approx 1.52$ are almost the same.

Tables 2 shows all $M \geqslant 8.2$ earthquakes in 1900-1933; Table 3 shows known $M \geqslant 8.2$ earthquakes in 1700-1899, the latter is clearly incomplete as no complete catalog of earthquakes in that period exists, the magnitude can only be estimated and the time and date of syzygies are subject to precision indicated in [12].

Tables 1, 2, 3 show that $M \geqslant 8.2$ earthquakes correlated with syzygies extremely well in 1938-2017 and in $1687 - 1835$. Not only there was no correlation in 1905-1918, but the number of earthquakes in $n = 3, 2, 1, 0$ was merely 2 out of 7, or 28.6% instead of expected 63%. The years 1919-1933 and 1835-1897 were somewhat of transition periods. The 1835-1897 transition period and the 1905-1918 no-correlation period almost coincided with the 1826-1910 wild ride of the magnetic North Pole discussed earlier. The 1977/8/19 earthquake in Table 1 struck merely four years after the change in the direction of motion of the magnetic North pole around 1973; the 1647/5/14 earthquake in Table 3 struck 15 years after the change in the direction of motion of the magnetic North pole around 1632.

Correlation of VEI $\geqslant 5$ eruptions with syzygies. Table 4 shows all known volcanic eruptions of VEI $\geqslant 5$ in 1707-2017. Of the eleven eruptions in 1913-2017, ten, or 90.9%, started within $12 + 24n$ hours of a syzygy or within $30 + n$ days of a syzygy-perigee; while formula (1) suggests 73.6%. A similarly good correlation was in in 1600,-1815; 15 out of 17, or 88.2%, of eruptions started within $12 + 24n$ hours of a syzygy or within $30 + n$ days of a syzygy-perigee. Of the 9 eruptions in 1822-1912 only one, started within 4.5 days of a syzygy or within 34 days of a syzygy-perigee.

The no-correlation period 1822-1912, when the volcanic eruptions of Table 4 did not correlate

[1] A syzygy-perigee is a syzygy within 12 hours of a perigee.

Date, volcano, VEI	pertinent celestial events	m
2012/7/18-19 Havre VEI=5, the largest underwater eruption known | 2012/7/19 syzygy		1
2011/6/3-4 Puyehue VEI=5	2011/6/1 21:03 syzygy	3
1991/8/8-12 Hudson VEI=5	1991/8/10 syzygy, 1991/7/11 syzygy-perigee	0
1991/6/15 Pinatubo VEI=6	1991/6/12 syygy, 1991/7/11 syzygy-perigee 1991/6/1 -1991/6/15 six X12.0 solar flares	0
1982/5/28 El Chichon VEI=5	1982/6/21 syzygy-perigee	0
1980/5/18 8:32 St. Helens VEI=5	1980/5/14 12:02 syzygy	4
1963/3/17 Agung VEI=5 ‖37 days before 1963/4/23 syzygy-perigee, 3 days short of $m = 4$		$\geqslant 5$
1956/3/30 Bezymianny VEI=5	1956/3/26 13:11 syzygy	4
1933/1/8 Kharimkotan VEI=5	1933/1/11 20:36 syzygy	3
1932/4/10 Cerro Azul VEI=6	1932/4/20 syzygy-perigee	0
1913/1/20 Colima VEI=5	1913/1/22 Full Moon, 1913/2/21 syzygy-perigee	2
1912/6/6 Novarupta VEI=6	38 days before very rare double syzygy-perigee on 1912/7/14 and 1912/8/12, 4 days short of $m = 4$	$\geqslant 5$
1907/3/28 Ksudach VEI=5	1907/3/29 syzygy	1
1902/10/24 Santa Maria VEI=5-6		$\geqslant 5$
1886/6/10 Tarawera VEI=5		$\geqslant 5$
1883/8/27 Krakatoa VEI=6	1883/9/1 syzygy	4
1875/3/29 Askja VEI=5		$\geqslant 5$
1854/2/18 Shiveluch VEI=5		$\geqslant 5$
1835/1/20 Cosiguina VEI=5		$\geqslant 5$
1822/10/8 Galunggung VEI=5	1822/11/29 syzygy-perigee, 18 days short of $m = 4$	$\geqslant 5$
1815/4/10 Tambora VEI=7	1815/4/9 18:23 syzygy	1
1808/12/ exact date is unknown but was prior to 1808/12/11, exact location is unknown, VEI=6, 1-25 days after 1808/11/17 New Moon-2nd closest perigee		0
1793/2/date is unknown, Alaid VEI=5 | 1793/1/12 syzygy-perigee,	most likely $m \leqslant 4$	
1783/6/8 Laki VEI=4-5	1783/6/15 Full Moon-closest perigee	0
1755/10/17 Katla VEI=5	1755/11/4 syzygy-perigee	0
1739/8/19 Tarumai VEI= 5	1739/7/20 syzygy-perigee	0
1721/5/11 Katla VEI=5	1721/6/10 syzygy-perigee	0
1707/12/16 Fuji VEI=5	1707/12/9 syzygy-perigee	0
1673/5/20 Gamkonora VEI=5	1673/5/16 syzygy	4
1667/9/23 Tarumai VEI=5	middle of Maunder Minimum	$\geqslant 5$
1663/8/16 Usu VEI=5	1663/8/18 syzygy	2
1640/12/26 Parker VEI=5	1640/12/28 Full Moon	2
1640/7/31 Komaga-take VEI=5	1640/8/1 syzygy	1
1631/12/16 Vesuvius VEI=5	path in Figure 3 turned 180°	$\geqslant 5$
1630/9/3 Furnas VEI=5	1630/9/7 New Moon-2nd closest perigee	0
1625/9/2 Katla VEI=5	1640/8/18 syzygy-perigee, 1640/8/1 syzygy	0
1600/2/17 Huaynaputina VEI=6	1600/2/14 New Moon	3

Table 4: VEI $\geqslant 5$ eruptions in 1600 - 2017. If $m = 4, 3, 2, 1, 0,$ then the eruption occurred either within m days of a syzygy or within $30 + m$ days of a syzygy-perigee, [12, 14]; $m \geqslant 5$ are not listed. Question mark "?" in the date indicates that only the year and month are known. Eruptions for which only the year is known are not listed.

with syzygies, was within the 1826 - 1920 wild ride of the magnetic North Pole. The 1673/5/2 eruption in Table 4 occurred 12 years before the 1684 change in the direction of motion of the magnetic North Pole; the 1956 - 1980 worsening of correlation of volcanic eruption with syzygies in Table 4 almost coincided with the 1955 - 1975 period when the path of the magnetic North Pole wiggled a bit.

The butterfly pattern. It was determined n 1960s, that the region of fallen trees was shaped like a giant butterfly 70 km across and 55 km long; it is shown in Figure 7. The portion of the butterfly's boundary marked with red dots closely follows the outer edge of elevated area, the portion marked with orange dots follows a ridge. It looks like the elevations around the epicenter, marked by the red cross, protected the trees behind them. That suggests that the shock wave itself traveled close to the ground, at the same height as the elevations nearby.

Figure 7: Butterfly pattern, map from [9].

Other similar and/or possibly related events. The epicenter of the Tunguska explosion $60.917^oN, 101.95^oE$ is inside the ancient Kulikovskii crater and near the kimberlite diamond pipe Mirny at $\approx 62.53^oN, 114.00^oW$, kimberlite pipe Udachnaya at $66.43^oN, 112.32^oE$ and gold mine Olimpiada at $\approx 59.86^oN, 92.914^oE$; all three believed to be created by eruptions of deep-origin volcanoes. The epicenter of the Tunguska explosion is about 607 km from Logancha Crater at $65.52^oN, 95.93^oE$; about 830 km from Patomskiy crater at $59.285^oN, 116.589^oE$ and almost exactly between the site of the Krasnojarsk meteorite at $54.9^oN, 91.8^oE$ and the Popigai crater at $71.65^oN, 111.183^oE$.

Violent earthquakes and meteorites not too far from the epicenter of the Tunguska explosion were reported a century earlier, [3]: "Upon Aug. 28, 1819, there was a violent quake at Irkutsk ... There had been two shocks upon Aug. 22, 1813 ... Upon April 6, 1805 ... two stones had fallen from the sky at Irkutsk ... Another violent shock at Irkutsk, April 7, 1820 ... "; "Upon Feb. 11, 1824, a slight shock was felt at Irkutsk, Siberia ... Upon February 18, or, according to other accounts, upon May 14, a stone that weighed five pounds, fell from the sky at Irkutsk ... Three severe shocks at Irkutsk, March 8, 1824 ... "; "Upon March 8, 1829, a severe quake, preceded by clattering sounds, was felt at Irkutsk. There was something in the sky. Dr. Erman, the geologist, was in Irkutsk, at the time. In the Report of the British Association, 1854-20, it is said that, in Dr. Erman's opinion, the sounds that preceded the quake were in the sky." Irkutsk's coordinates are $52.283^oN, 104.283^oE$. The events were contemporary to the New Madrid earthquakes and the VEI=7 eruption of Tambora in 1815. The correlation of $M \geqslant 8.2$ earthquakes was broken about 10-15 years later in ≈ 1835; the correlation of $M \geqslant 8.2$ earthquakes with syzygies was restored in $\approx 1922 - 1933$, 14-27 years after the Tunguska explosion.

The two popular databases of earthquakes [7, 9] provide remarkably different picture of seismic activity in 1900 - 1908. According to [9], the year of the Tunguska explosion was extraordinarily void of powerful earthquakes with merely two M=7.0 earthquakes, both in December; way less than the average of ≈ 11.37 per year obtained by dividing the total of 1353 $M \geqslant 7.0$ earthquakes in 1900 - 2017 by the number of years. There was at least one $M \geqslant 7.5$ earthquake almost each year in 1900 - 2017, the only exceptions other than 1908 were: 1925, 1967, 1982 when the strongest earthquake of the year was of M=7.2 - 7.4. Database [7] shows much more seismic activity at the time, there were ten $M \geqslant 7.0$ in 1908 alone and many more in 1905 - 1907; there were eight $M \geqslant 8.2$ earthquakes in 1905 - 1906, more than in any other two-year period in 1900 - 2017. The database also shows unusual pairing of $M \geqslant 8.2$ earthquakes in 1900 - 1906: two earthquakes on 1906/8/17, two earthquakes in 1906/1/21-31, two earthquakes in 1905/7/9-23, two earthquakes on 1901/8/9, and two earthquakes in 1900/10/9-29, such pairing of $M \geqslant 8.2$ earthquakes has not been observed either before 1900 or after 1908.

Search of [7] shows only six $M \geqslant 8.2$ earthquakes in Central Asia: 1725/2/1 at $56.5^oN, 118.5^oE$, 1889/7/11 at $43.2^oN, 78.7^oE$, 1895/7/8 at $39.5^oN, 53.7^oE$, 1905/7/9 at $49.^oN, 99.^oE$, 1905/7/23 at $49.^oN, 99.^oE$, 1906/12/22 at $43.5^oN, 85.^oE$; four of them struck in July within 32 days after the summer solstice, two struck within 42 days of the winter solstice. Search of [7] for earthquakes of $M \geqslant 5$ in 1550 - 2018 in the region $48^oN - 81^oN$, $88^oE - 116^oE$ returns the following results The seismic activity in the region started around 1742, peaked around 1905 and has been steadily declining since then.

The Tunguska explosion occurred merely two days after June 28, 1908 solar eclipse.

Discussion. The manuscript was rejected by the *Earth, Moon and Planets*, based on the referee's

date, magnitude	location
1742/6/27 M=7.7, 1769/10/24 M=7.3, 1829/3/7 M=7.5, 1862/1/12 M=7.5, 2008/8/27 M=6.2	$51.4^oN - 53.3^oN, 104^oE - 106.7^oE$ near lake Baikal
1761/12/9 M=7.7, 1903/2/1 M=7.8, 1905/7/9 M=8.4, 1905/7/23 M=8.4, 1967/1/5 M=7.5	$48^oN - 50^oN, 90^oE - 102^oE$ in Mongolia
2011/12/27 M=6.7	at $51.9^oN, 95.9^oE$

report "…it's not a scientific paper, but a collection of randomly chosen 'coincidences' …the author suggested a single explanation for several 'coincidences' …" But how likely is it that a random celestial body, be that meteorite, comet, or anything else,accidentally strike 1) at the location both the third geomagnetic maximum and the magnetic North Pole are heading to; 2) at the location pointed to by the arrow of earthquakes shown in Figure 5; 3) in the year with the least number of powerful earthquakes; 4) merely two days after a solar eclipse? Very unlikely. Nor is it very likely that the correlation of earthquakes to syzygies, shown in Tables 1, 2, 3; the correlation of volcanic eruptions to syzygies, shown in Table 4; and the smoothness of the path of the magnetic North Pole coincidentally show the same pattern. What we have here is not mere coincidences but different facets of a slowly-unfolding colossal geological event gone unnoticed by people; the Tunguska explosion was merely a facet of the event. One possible explanation the event might be that currents of ionized fluid escaped the confines of the liquid core, crossed the mantle and reached the crust, leading to the earthquakes in Figure 5, 6, and affecting the correlation of seismic activity with syzygies.

The Tunguska explosion itself may have been caused by one of the currents reaching very close to the surface; the electric charges inside the current induced a charge of the opposite sign in the ionosphere, resulting in a magnetic storm and lightenings and/or earthquake lights of immense proportions observed by witnesses. Parts of the liquid metal inside the current may have been shot to the atmosphere, where they flew like, and were mistaken for, meteorites. According to [11], 'there is some evidence suggesting that following the explosion-like energy release at least a part of the Tunguska …Body continued to move …upwards'.

The hypothesis would explain the unusual electromagnetic phenomena which accompanied the Tunguska explosion: 1) extreme brightness of the skies of Eurasia for the first three nights after the Tunguska explosion; 2) a five-hour geomagnetic storm detected minutes after the Tunguska explosion by scientists at the Magnetographic and Meteorological Observatory in Irkutsk, it was not detected by any other magnetometric station on the planet; 3) unusual pulsations in the Earth's magnetic field detected by L. Weber of Kiel University as well as other events contemporary to the Tunguska explosion.

Clearly such an event could not be unique, similar events must have happened in the past with some currents not just reaching close to the surface but coming out of the surface and leaving behind unexplained microscopic magnetic spheres in the Tunguska soil, high-pressure carbon allotropes containing inclusions of troilite, iron-nickel alloy taenite and schreibersite found in diamond-lonsdaleite-graphite micro-samples, yttrium and ytterbium. Similar events in the past might have created kimberlite pipes Mirny and Udachnaya and gold mine Olimpiada; and may explain the phenomena near Irkutsk in early 1800s described in the previous section. Some of such currents in the past may have created the Great Blue Hole with its remarkably rounded walls containing iron, [1]; and the Nastapoka arc surrounded by numerous craters and generous deposits of iron and nickel.

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eruptions of Azul Cerro in 1916, Agung in 1843, Tangkoko-Duasudara in 1680, Long Island in 1660, Sheveluch in 1652, Raung in 1593, Kelut in 1586, Billy Mitchell in 1580 ± 20 are not listed in Table 4 because only the year of the eruption is known. 8

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