Tunguska explosion revisited.

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Abstract. A few aspects of the Tunguska explosion unnoticed until now are reviewed.

Key words: Tunguska explosion.

It has been 110 years since the June 30, 1908 explosion at $60.917^o N, 101.95^o E$ 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, [6].

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. According to Figure 1, a third geomagnetic maximum, pointed to by an arrow in frame '1900', appeared in Asia not too far from

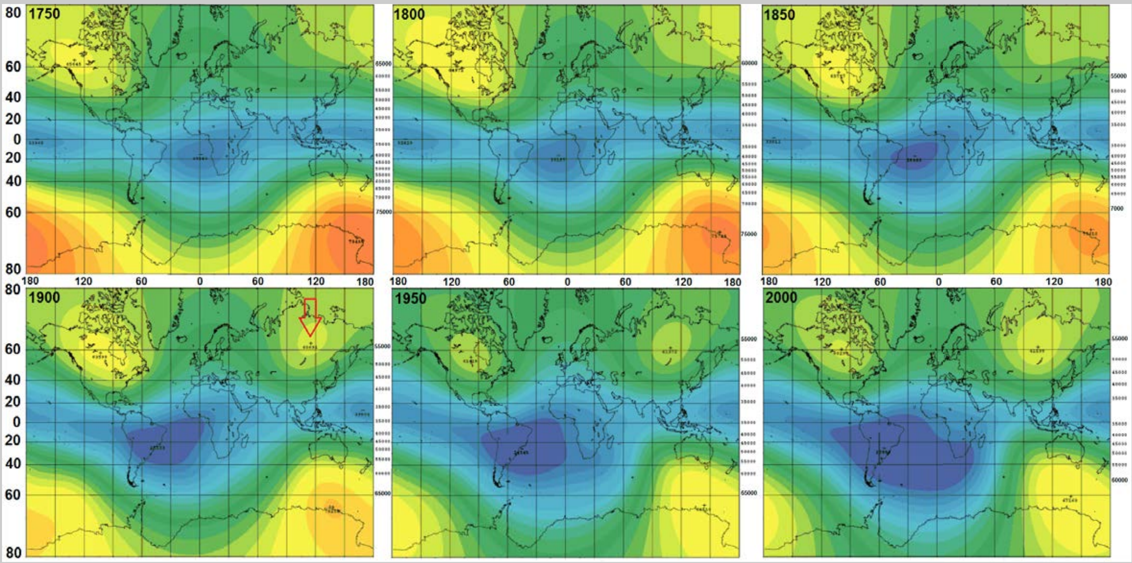

Figure 1: Total intensity of the Earth's magnetic field in nT for 1750 - 2000 in IGRF model, [2].

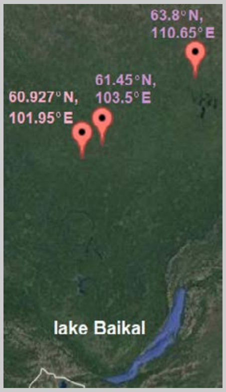

Figure 2: Location of the geomagnetic maximum on 1908/6/30 and 2017/12/6 and Tunguska explosion,[4, 9].

the epicenter of the Tunguska explosion sometime in 1850 - 1900; although it must have started forming in 1800 - 1850, but was not large enough to show in Figure 1. 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. On 2017/12/6 IGRF placed the geomagnetic maximum 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 geomagnetic maximum on 1908/6/30 and 2017/12/6 are almost on the same line; of course, the geomagnetic maximum does not move strictly along a straight line but close to it. If the motion of the geomagnetic maximum continues unchanged, it should reach the epicenter of the Tunguska explosion in 30 -35 years.

Intraplate seismic activity. The left frame of Figure 3 shows earthquakes of $M \geqslant 7.6$ in 1900 - 2016; 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.

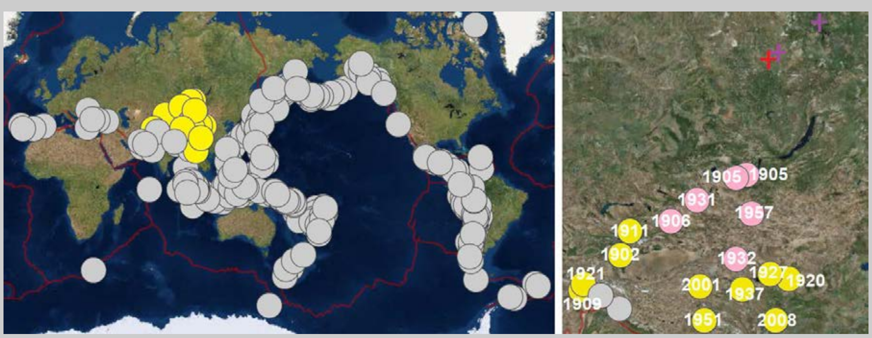

Figure 3: M $\geqslant$7.6 earthquakes southwest of the Tunguska explosion, [7, 9].

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, 6 struck in 1902 - 1911; 6 in 1920 - 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 4 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.

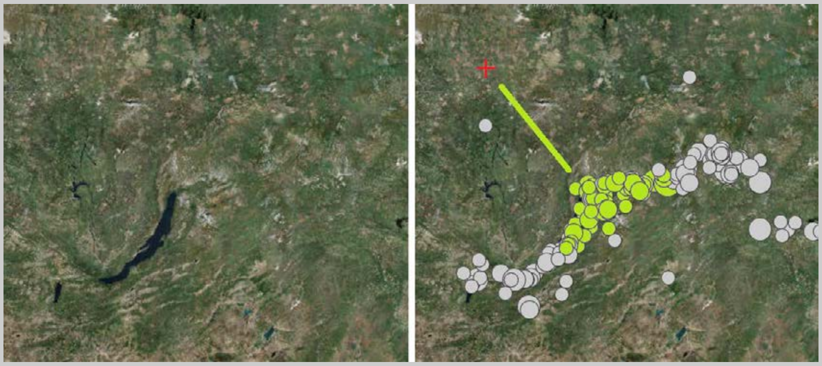

Figure 4: M $\geqslant 4.6$ earthquakes with latitude from $50^o N$ to $70^o N$, and longitude from $100^o E$ to $130^o E$, [7].

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 5. The portion of the butterfly's boundary marked with red dots closely follows the edge of elevated area while the portion marked with pink dots is just a few kilometers away from elevations. 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. In some sources the butterfly pattern is in a slightly different position but not by much.

Figure 5: Butterfly pattern, map from [7].

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

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

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

Date, time, M	syzygy, if within 84 hours; syzygy-perigee, if within 33 days	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, [7, 8]. If $n = 0, 1, 2, 3$, 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 $n = 0, 1, 2, 3$ are considered.

Date, time, M	syzygy, if within 84 hours; syzygy-perigee, if within 33 days	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, [7, 8]. If $n = 0, 1, 2, 3,$ then the earthquake struck either within $12 + 24n$ hours of a syzygy or within $30 + n$ days of a syzygy-perigee.

Date, time, M	syzygy, if within 84 hours; syzygy-perigee, if within 33 days	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 earthquakes of M=8.4	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	1787/4/2 syzygy	$\geqslant 4$
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	$\geqslant 4$
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 earthquakes of M $\geqslant 8.2$ in 1687 - 1899, [8, 10]. If $n = 0, 1, 2, 3,$ 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 [8] loses its precision as we go back in time.

Date, volcano, VEI	syzygy, if within 4 days; syzygy-perigee, if within 38 days	m
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	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 $m=4$		
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 $m=4$	
1907/3/28 Ksudach VEI=5	1907/3/29 syzygy	1
1902/10/24 Santa Maria VEI=5-6		
1886/6/10 Tarawera VEI=5		
1883/8/27 Krakatoa VEI=6	1883/9/1 syzygy	4
1875/3/29 Askja VEI=5		
1854/2/18 Shiveluch VEI=5		
1835/1/20 Cosiguina VEI=5		
1822/10/8 Galunggung VEI=5	1822/11/29 syzygy-perigee, 18 days short of $m=4$	
1815/4/10 Tambora VEI=7	1815/4/9 18:23 syzygy	1
1793/2/? Alaid VEI=5	1793/1/12 syzygy-perigee, most likely $m=0-4$	
1755/10/17 Katla VEI=5	1755/11/4 syzygy-perigee	0
1739/8/? Tarumai VEI= 5	1739/7/20 syzygy-perigee, most likely $m=0-4$	
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
1663/8/16 Usu VEI=5	1663/8/18 syzygy	2
1640/7/31 Komaga-take VEI=5	1640/8/1 syzygy	1
1625/9/2 Katla VEI=5	1640/8/18 syzygy-perigee, 1640/8/1 syzygy	0
2012/7/18-19 Havre VEI=5, the largest underwaster eruption known | 2012/7/19 syzygy		1

Table 4: VEI $\geqslant 5$ eruptions in 1601 - 2017. If $m = 0, 1, 2, 3, 4,$ then the eruption occurred either within m days of a syzygy or within $30 + m$ days of a syzygy-perigee, [8]; $m \geqslant 5$ are not listed. Question mark "?" in the date indicates that only the year and month are known. The 1800 eruption of St. Helens is not listed as only the year is known.

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

The 2006/11/15 M=8.3 earthquake was the most recent M $\geqslant 8.2$ earthquake that did not correlate with the Moon; it started the eleven-month season with the most M $\geqslant 8.0$ earthquakes in 1900 - 2017. There were five M $\geqslant 8.0$ earthquakes in 2006/11/15 - 2007/9/29, while there were 93 M $\geqslant 8.0$ earthquakes in 1900 - 2017 averaging ≈ 0.722 earthquakes per eleven months, [7]. The 1977/8/19 M=8.3 earthquake was the second most recent M $\geqslant 8.2$ earthquake that did not correlate with the Moon; it started the 1977/6/20 - 1985/3/3 M $\geqslant$ 8.0 earthquake drought, the longest period in 1900 - 2017 without a M $\geqslant$ 8.0 earthquake, [7].

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 [8].

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 majority of earthquakes in the right frame of Figure 3 struck before 1938

Correlation of VEI $\geqslant$ 5 eruptions with syzygies. Table 4 shows all known volcanic eruptions of VEI $\geqslant$ 5 in 1707 - 2017. Of the ten eruptions in 1907 - 2017, nine, or 90%, started within $12+24n$ of a syzygy or within $30+n$ days of a syzygy-perigee; while formula (1) suggests 73.6%. A similarly good correlation of 80% - 100% was in in 1707 - 1822. Of the six eruptions in 1835 - 1906 only one, or 1.7% started within 4 days of a syzygy or within 34 days of a syzygy-perigee versus 73/6% suggested by formula (1).

Motion of the magnetic North Pole. The correlation of seismic activity seems to be mirrored by the motion of the magnetic North pole. The sudden southwards twist in the motion of the

Figure 6: Track of the magnetic North Pole, [5]. Yellow squares indicate observed locations.

magnetic North pole in 1828 - 1910 is chronologically close to the worsening of correlation of earthquakes to syzygies in 1835 - 1933 in Tables 1 - 3 and the worsening of correlation of volcanic eruption to syzygies in 1835 - 1902 in Table 4; the period overlaps with the Dalton minimum. The 1600 -

1684 northwards loop in the motion of the magnetic North pole is chronologically close to the the 1647/5/14 earthquake in Table 3 and 1673/5/2 eruption in Table 4; it overlaps with the Maunder minimum. The change in the direction of motion of the magnetic North pole around 1973 is chronologically close to the 1977/8/19 earthquake in Table 1 and the worsening of correlation of volcanic eruption to syzygies in 1956 - 1980 in Table 4. The southwards loop in the motion of the North magnetic pole around around 1700 did not affect known seismic activity of the time, most likely because we have only limited knowledge of the latter. The Tunguska explosion occurred at the end of the 1831 - 1910 southwards twist in the motion of the North magnetic pole.

Circles around the epicenter of the Tunguska explosion. Tunguska explosion of 1908 did not leave any craters. However, as Figure 7 shows, the epicenter of the Tunguska explosion, marked by the red cross, is surrounded by a number of non-concentric circles of unknown origin, indicated by small colored dots.

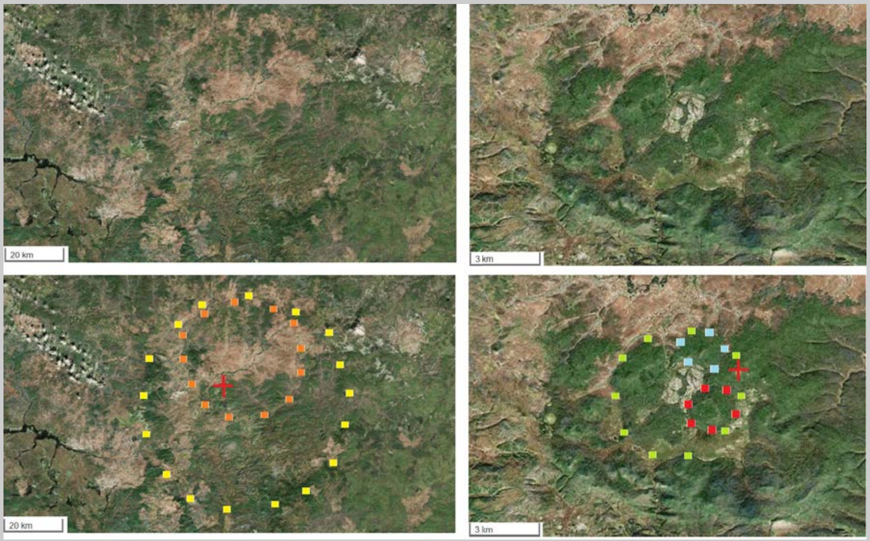

Figure 7: Circles around the epicenter of the Tunguska explosion, [7].

Other similar and/or possibly related events. The epicenter of the Tunguska explosion and the new geomagnetic maximum are 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 $\approx 59.86^oN, 92.914^oE$; al 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 $52.283^o N, 104.283^o E$. 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 year of the Tunguska explosion was extraordinarily void of powerful earthquakes with merely two M=7.0 earthquakes, both in December. For comparison, almost each year in 1900-2017 had at least one M $\geqslant 7.5$ earthquake; the only years without a M $\geqslant 7.5$ earthquake other than 1908 were: 1925, 1967, 1982 when the strongest earthquake of the year was of M=7.2-7.4, [7]. The 1900-2017 period had the total of 1353 earthquakes of M $\geqslant 7.0$, averaging ≈ 11.37 per year, or ≈ 5.7 times more than 1908.

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

Discussion. It is very unlikely that the events and phenomena discussed here happened to be close both geographically and chronologically by mere coincidence; most likely, they are but different facets of a colossal geological event gone unnoticed by people. We may hypothesise that the event originated in the liquid core and caused currents of ionized fluid to escape the confines of the liquid core, cross the mantle and reach the crust. The currents lead to the earthquakes of Figure 3, 4, and affected the correlation of seismic activity with syzygies. The Tunguska explosion may have been caused by one of the currents when it got 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. The drastic increase to the geomagnetic field in the region due to the currents may have also attracted a number of small iron-rich meteorites, the same way a magnet attracts iron nails, which burned in atmosphere before reaching the surface of the Earth.

The hypothesis would explain 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 the almost-perfectly circular structures shown in Figure 7, 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.

The geomagnetic maximum has been moving more-or-less along a straight line towards the epicenter of the Tunguska explosion, the two should merge or come very close in 30-35 years; what happens then may finally reveal the true nature of the Tunguska explosion.

References

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