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Crisis of the meteorite paradigm:

craters, tektites, the Tunguska event

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In the book, questions of Earth's craters exploration and origin of tektites on our planet are brought up. It is shown that our knowledge in this field remains limited so far and demand revision of the data interpretation.
In the context of the Tunguska 1908 phenomenon, we suppose correlations between the Perm LLSVPs Anomaly and the explosion of paleovolcano in Siberia on 30 June 1908. We discuss magnetic pulsations in Kiel, Germany observed from 27 till 30 June 1908, a variation of gravitational constant during the solar eclipse on 28 June 1908, and the discrepancy of Moon longitude at the beginning of the 20th century. The non-typical registrations in Tasmania in the period of the Tunguska 1908 phenomenon and his connection with the Perm LLSVPs anomalies provide a highly probable solution to one of the greatest mysteries of the previous century.

For astro- and geophysicists and a wide range of readers who are interested in meteorites and planetology.

PART III. THE TUNGUSKA 1908 ENIGMA

'The Tunguska phenomenon

is one of the greatest mysteries

of the previous century'.

CHAPTER 5. The final solution of the Tunguska problem

5.1. Introduction

A powerful explosion, which was equivalent to 5÷40 megatons of TNT, occurred in the so-called Kulik-caldera in Eastern Siberia on 30 June 1908. The blast felled trees in an area over 2150 km^2. Barometric/seismic disturbances and air-glows were detected worldwide. For three nights following the explosion, skies over Eurasia were exceptionally bright. Glows diminished rapidly thereafter.

Geographical boundaries of airglows were limited by the Yenisei River in the East, the Atlantic shore in the West, along Tashkent–Stavropol–Sevastopol–Bordeaux line in the South, and at least along Aberdeen–Stockholm line in the North (the northern border merged with the area of 'white nights' ordinary in summer).

It is generally accepted that the Tunguska event resulted from the explosion of an asteroid or a comet. However, there is no common agreement that the bolide really existed.

The Eastern Siberia is the field of proto-kimberlite pipes. They are spread out over a few hundred kilometers. In the catastrophe 1908 layer, not meteoric debris has been discovered, but an abundance of acute-angled long particles, which is a characteristic of kimberlite magma [Marshinzev, 1990].

Although more than 100 years have already passed since the Tunguska event, the scientific community is still far from understanding what happened in Siberia on 30 June 1908, and now the debate about the Tunguska event of 1908 continues.

5.2. NLCs luminescences during the Tunguska event

It has been assumed that these NLCs were a direct result of the increase in water vapor and meteoric nuclei in the atmosphere because of the intrusion of a cosmic substance of the comet. However, it has been revealed that during of the peaks of meteor showers Arietids (June, 8th), ξ-Perseids (June, 9th), Aquarids (July, 28th), and Perseids (August, 12th) a significant increase in the activity of NLCs clouds does not occur [Fogle, 1966a]. Moreover, the peak of NLCs activity occurs around July 10th, when there is no major meteor shower. These and other results [Farlow, 1973; Rajchl, 1986] indicate that the formation of NLCs is not dependent on cometary meteors showers.

We stress that there are significant unsolvable problems for all theories, which accept of NLCs as major luminescences during the Tunguska phenomenon.

Firstly, NLCs may be visible from the ground only when the atmosphere an altitude of 82 km is sunlit. These conditions are fulfilled when the sun is not more than 16° below the observer's horizon [Fogle, 1966a]. However, at night on 30 June 1908 in such cities as Tashkent the solar depression was more than 26°, that is, the atmosphere was directly lit by the rays of the Sun at an altitude of 700 km. It is clear that in this case NLCs could not be observed. Nevertheless in Tashkent, the sky was of such brightness that photographic exposures with a normal astrograph were not possible at all [Fessenkov, 1963].

Secondly, on 30 June 1908 in 12 points (London, Prague, Hamburg, Bordeaux, Dublin, Hirshberg, Uindermir, Hempsted, Kherson, Krakow, Tiraspol, and Miass) where strong luminescence was observed, NLCs were absent [Zotkin, 1961].

Thirdly, during the Tunguska event the observed brightness of the sky was estimated ranging from 10^{-7} to 10^{-6} stilb [Bronshten, 2000]. However, the brightness of NLCs was lower usually.

In addition, NLCs are so tenuous that stars shine through them almost undimmed. But on 30 June 1908, the luminescence in several regions did not allow stars to be seen [Vasilyev, 1965].

It is known well that the summer months are the best time for the appearance of noctilucent clouds and hence NLCs probably were not unusual in the Northern Hemisphere from 30 June to 2 July 1908 [Schreder, 1990]. Consequently, the concept of a dominating role of NLCs in the mechanism of 'bright nights' can no longer serve in favour of the comet hypothesis for the Tunguska event [German, 2010d].

Because hydrogen from methane reacts with atmospheric oxygen to form the water vapor required for NLCs, the volcanic ejection of methane could induce an abnormal field of NLC in the summer of 1908 [Kundt, 2001]. However, geological data indicate small quantities of methane deposits in the Tunguska region, where carbon dioxide dominates [Bhatov, 2000]. Therefore, in our opinion, NLCs could not be the main optical anomalies of the Tunguska phenomenon.

5.3. Was there cometary dust?

Earlier it has been proved [Turko, 1982] that it is impossibly to explain 'bright skies' after the Tunguska explosion by any optically active cometary dust particles because they can not remain above 100 km for a period of days.

Air-glows of the Tunguska event for the first time were observed in Germany, Holland, Great Britain, Poland, and Russia already on 22 June 1908 [Süring, 1908]. They exponentially increased from 30 June to 2 July and diminished abruptly thereafter. The brightest sky glows were observed over Belgium and West Germany (especially the Eifel volcanic area) and over a Vrancea zone in the Carpathians [Romeiko, 1997], and a more weak one over the Yellowstone volcano [Vasilyev, 1965]).

After explosions in Siberia, the first observation of a solar halo over England [Backhouse, 1908] and the air-glows over Christiania (now Oslo) occurred before noon on 30 June 1908. The dust obviously could not have originated at Kulik-caldera some 6000 km away. However, the Rayleigh surface waves with a vertical component (i. e., seismic infrasound waves) could have propagated to Europe. The seismic waves both before the explosion and after explosion have really been registered [Szirtes, 1913]: at Bidston, Tashkent, Tiflis, Jena, Potsdam, Hamburg on 28 June; at Hamburg, Strassburg, Jena on 29 June; at Tashkent, Jena, Potsdam, Christiania, Hamburg, Belgrade, Tiflis on 30 June; at Tiflis, Edinburgh, Potsdam, Jena, Graz, Shide, Kew, Bidston on 1 July, and at Tashkent on 2 July 1908. At all these cities the sky glows were observed during the Tunguska event.

In addition, the gamma-ray flux and ionization from radon decay products propagate to long distances and cause an increase in electrical conductivity of the atmosphere [Liperovsky, 2005]. We found that an ionization increase has been already recorded on 15 May 1908 in the Atlantic Ocean, and stronger at the coast of at Hornsea, England on 2 July 1908, i. e., immediately after the Tunguska explosion [Eve, 1908], as well as in Berlin, Germany in July 1908 [Flemming, 1908].

On 30 June 1908 F. Bush has defined the height of the orange clouds over North Germany equal 52 km [Bush, 1908] (it is interesting that the dust cloud after the eruption of Agung volcano on the island of Bali on 17 March 1963 had a primary glow stratum at a height of 22 km and some indication of a secondary one at 53 km [Meinel, 1963]). According to the APO data, the turbidity spectrum in July 1908 closely corresponds to that seen shortly after the Katmai volcano eruption in 1912 [Volz, 1975]. Therefore, with a high level of probability the dust layer, water vapor and the opacity over Eurasia in the summer of 1908 could be caused not a comet, but by the eruption of the Tunguska paleovolcano in Siberia and activation both the Eifel volcanic area in Belgium/Germany and the Vrancea zone in the Carpathians.

Supporters of the comet hypothesis come across an insurmountable obstacle [Gladysheva, 2008; Gladysheva, 2009]: '*It turned out that the release of energy of the Tunguska explosion occurred exactly above the central conduit of the ancient volcano*'. Because 'attractive' zones for comets have not yet been detected, it is clear that the explosion of comet exactly over the central conduit of paleovolcano is non-probable. However, the heliometeorologic zones on Earth are known [Obridko, 1996; German, 2010b]. They include also the Baikal-Turukhansk direction, going through the Cheko lake and corresponds to so-called the 'Krinov-meteorite' trajectory, along which the strong thunderstorm with hailstones has been observed at Nizhny-Karelino on 30 June 1908 [German, 2007].

We remind, that the outflow of traps basalts in Eastern Siberia 248 million years ago led to the extinction of species on Earth. Thus, as the main version remains the explosion of the Tunguska volcano.

5.4. Spread ionospheric phenomena

In our opinion, it is possible to offer more adequate hypotheses for an explanation of 'bright nights' during the Tunguska event. It has been found that so-called spread effects exist, which mainly due to plasma instabilities produce irregularities in the E- and F layers of the Earth's ionosphere. The spread phenomena usually last about one week. It was shown that days before earthquakes, even before rather weak ones, the turbulence of the plasma of ionospheric layers changes [Liperovskaya, 2006].

There are images that clearly showed patches of turbulence associated with spread ionospheric bubbles drifting across the sky [Taylor, 1997]. During the spread effects both the produced structures and the altitude covered with them can reach more than 1000 km [Liperovskaya, 2009]. For example, enhancements of light ion density have been observed by satellites in the inner plasmasphere at altitudes of 2000-2500 km above the seismically active zone prior to the Iranian earthquake on 20 June 1990 [Boskova, 1994], and ionospheric variations during the Wenchuan earthquake which occurred in China on 12 May 2008 extended more, than 1500 km in latitude and 4000 km in longitude [Yiyan, 2009]. The above parameters fit observations air-glows of the Tunguska event.

Furthermore, we suppose that increased ionospheric conductivity could contribute to the formation of so-called 'earthquake lights'. It is known that earthquakes can trigger new quakes from afar (e.g., the Sumatra 2004 earthquake may have weakened the San Andreas Fault [Silver, 2007]).

The spread phenomena probably result from vertical coupling processes involving upward propagation of atmospheric waves (in the form of tides, gravity- and planetary waves) from the lower atmospheric areas of their origin to the dynamo region in the ionosphere [Abdu, 2009].

It was shown that the anomalous frequency changes before the earthquake onset can be caused by unknown super-volt seismic discharges [Ondoh, 2000]. The electromagnetic ULF waves radiated by hypocentral zones during pre- and seismic periods may cause charged particle flux precipitation from the plasmasphere [Sgrigna, 2002]. This mechanism possibly explains why eyewitnesses saw an object shaped like a pipe moving vertically down for about ten minutes in the epicenter of the Tunguska area on 30 June 1908.

5.5. Polarization effect of the Tunguska event

For the first time, solar vortex structures were observed in 1857. On 5 May 1907, the same structures were registered again. A. Stentzel has paid attention to the effect of a 50-yr period of these structures [Stentzel, 1907]. A recent analysis of geomagnetic secular data along with yearly Wolf sunspot numbers (known from 1700 until present) shows that cycle about the 50-yr is very significant and possibly indicates an oscillation of a solar field with period 66-yrs superimposed on the main field with period 11-yrs [Slaucitajs, 1965; Lomb, 1980].

Since April 1908 A. Stentzel noted optical anomalies in the low layers of the atmosphere, at a height of 35-50 km [Stenzel, 1909], and on 30 April 1908 luminous clouds were observed at a height of 35 km over Portsmouth, England [Cave, 1908]. At the same time, on 29-30 April 1908 G. Hale on Mount Wilson, USA again observed vortical structures in the Sun, and later on 25 June 1908 he has registered magnetic fields of sunspots for the first time [Hale, 1908b].

An effect of displacement for neutral points of the sky polarization both Arago and Babinet in the Earth atmosphere, similar to a polarization effect during the Tunguska 1908 event, for the first time, was observed by F. Bush at Arnsberg, Germany in April 1903 [Jensen, 1937]. The inversion of speeds for Arago/Babinet neutral polarization points, when the rate of increase of Arago point has exceeded the rate of increase of point Babine, has been noted since 10 May 1907 [Jensen, 1909]. Increasing the angular distance of neutral polarization points, which has begun in May 1907, proceeded till the end of June 1908. Exactly after the Tunguska explosion, the maximum relative increase of the polarization for the whole period from 1905 to 1910 was recorded [Jensen, 1937]. In our opinion, this effect could correlate with above-mentioned vortex structures on the Sun.

Recently it has been proved that a new index of the solar rotation *M*, defined by integrating the angular momentum density over the whole solar surface, reached a maximum at solar cycle 14 (1901.7-1913.6) [Yoshimura, 1993] (the next maximum at cycle 21 had a relatively small amplitude). The vortex structures observed on the Sun during the years 1907-1908 [German, 2007, 2008a, 2010a] probably reflect an acceleration of surface layers during transport of angular momentum from, or into, deeper layers (due to a radial gradient because an equatorial gradient reached a minimum in cycle 14).

Usually, a 'classical' minimum for a neutral Arago point was observed when the Sun was under the horizon with the angular position between ξ_o=-0.5° and ξ_o=-1.5°. However, daytime polarization measurements by Busch at Arnsberg indicated that for one day before the Tunguska explosion this minimum was displaced when the solar angular elevation was positive (ξ_o=+0.5°) [German, 2009b, Fig.1].

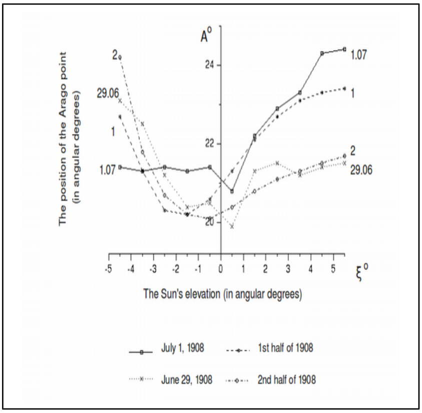

Fig. 7. *Change in the position of the Arago point during the first and second half of the year 1908. Based on data from [Jensen, 1937].*

Given the identity of the position of this minimum both on 29 June, and on 1 July 1908 its shift has no direct relation to the effects of the Tunguska explosion on 30 June 1908. Obviously, a drift of minimum of the Arago point allows us to assert that the effect of violations of the polarization was already present on 29 June and continued on 1 July 1908.

The curve for the Arago point on 29 June 1908 already corresponded to the average curve of the second half of 1908 and it is one of the confirmations of the version about the occurrence of polarization anomalies well before the Tunguska explosion. We found that from 29 June to 1 July 1908 the effect of polarization anomalies extended in a direction from the lower layers to the upper layers of the atmosphere [German, 2009b, Fig.1], but not vice versa, as would be expected in case the cometary/asteroidal substance had penetrated from the space into the Earth's atmosphere.

On the other hand, when the Sun under the horizon is at an angular position of ξ_o=-12^o and then ξ_o=-18^o, polarisation minima are also registered. They are explained by the change (by increase) in critical frequencies of ionospheric layers [Hvostikov, 1936]. In turn, change of frequencies is caused by the following: at twilight, an intensity of pulsations of an electric vector of the Earth's field directed parallel to a plane of scattering of light, reaches a night maximum earlier, than the stronger perpendicular vector [Hvostikov, 1936; German, 2012b, p. 119]. That is, the nature of depolarization is not always caused by dust, and can depend on changes in the intensity of the Earth's electric field.

The situation of the inversion for the speeds of neutral points had been repeated later in 1919 [Jensen, 1937]. In fact, the 11-yr cycle between 1908 and 1919 allows the suggestion of a relation of the polarization effect to solar activity.

Some articles discuss the problem of the Tunguska event's influence on the Earth's ozone layer [Turko, 1981; Kondratyev, 1988]. The general blue coloring of NLCs is caused by the absorption of incident sunlight by ozone in the Chappuis bands. Archival atmospheric transmission of the APO data from the period of 1908 to 1911 have been analyzed for Chappuis band absorption; the data imply an ozone reduction of 30(±15) % [Turko, 1981]. The ozone perturbations can be explained by large stratospheric injections of nitrogen oxides, which may be produced, for example, by solar proton events. On the other hand, the ozone layer could be violated by the dynamic effects of the paleovolcano activation in Siberia on 30 June 1908. The ozone reduction can cause various physical effects. During the Tunguska event, observers reported phenomenal transparency of the atmosphere. Possibly, that was caused by a falling of the finest dust in the stratosphere. However, it is known in atmosphere physics, that when the thickness of the ozone layer is less than the thickness of the sub-ozone layer (that is when the Buger's law is violated), then the transparency is also increasing. Therefore, as one of the versions of an explanation of the polarization effect of the Tunguska phenomenon we can offer a violation of the ozone layer and the changes of atmospheric scattering connected with it. Thus, the polarization effect of the Tunguska event could have correlations with solar activity, fluctuations of the Earth's electromagnetic field, and, as a consequence, with tectonic activity. Therefore, the data for the polarization effect of the Tunguska event disagree with the hypothesis of an encounter of the Earth with a fragment of an asteroid or a comet.

5.6. Superposition lunar-solar and geomagnetic disturbances

During the Tunguska event Prof. L. Weber, of Kiel University, reported regular magnetic oscillations with a period of 3 min. on 27-30 June 1908. These strange disturbances occurred [Weber, 1908]: June 27/28 – from 6:00 p.m. to 1:30 a.m., June 28/29 – the same, June 29/30 – from 8:30 p.m. to 1:30 a.m. There are several intriguing aspects of registrations in Kiel:

pulsations were detected in the evening/night time only and ended on 30 June 1908 at 0:30 UT, i.e., through 15 min. after the explosion in Siberia. Therefore, the source of pulsations in Kiel is one of the key factors for the solution of the Tunguska 1908 enigma.

According to the typical classification scheme of pulsations, oscillations with a period of about 3 min. are continuous compressional Pc5 pulsations in the ULF range from 2 mHz to 8 mHz.

Ionospheric effects of earthquakes are often superposed with solar and geomagnetic disturbances. Probably, it not a random coincidence. Although a period of p-mode oscillations of the solar corona is equal to 5 min., a period of pulsations of high layers of the photosphere and layers of deeper, than the photosphere, is equal to 3 min. (5-7 mHz). These solar gravity acoustic waves of g-modes (i.e., so-called 'acoustic' halo) correlate with both strong magnetic fields and global oscillations on the Sun during flares and escape from the Sun. Further, the interplanetary magnetic field (IMF) interacts with the Earth's magnetic field and causes it to oscillate, producing detectable ULF pulsations (in the solid Earth, etc.) in resonance with the characteristic of solar waves [Thomson, 2008]. It is well-known that the tangential component of IMF has no compensation, as IMF possesses daily variations with a local peak of intensity at around 18 h local time. This time coincides with the beginning of Pc5 pulsations with a period of 3 min. registered by L. Weber at Kiel on 27-30 June 1908 [Weber, 1908], and it points out the Sun's fields as well. As Pc5 pulsations in Kiel were registered in the evening/night time we may assume that the well-known mechanism of the radial diffusion caused injections of the solar plasma into the magnetosphere at the night side of the Earth. A period of pulsations in the Earth's magnetosphere depends on the plasma's density distribution. Therefore, Pc5 pulsations exist as oscillations of geomagnetic lines distorted by the solar wind or by changes in the ambient plasma density at distance 6,3 R_E (R_E is the radial distance from the Earth's center). It is known that terrestrial magnetic storms have a connection with CMEs (coronal mass ejections), i.e., with magnetic clouds, and with CIR, i.e., corotating interaction around the Earth. Therefore, the ULF waves well associate with magnetospheric substorms. Note, the outer magnetospheric radiation belt approaches the Earth's surface about 60°-latitude, i.e., about the latitude of the Tunguska Basin. After the Tunguska explosion on 30 June, 1908, the observatory in Irkutsk registered a magnetic substorm lasting ~ 4.5 hours. Therefore, registrations of 3 min. (ULF) geomagnetic pulsations in Kiel, Germany on 27-30 June 1908 can correlate with oscillations of stellar (solar) flares [German, 2012a, 2013c].

The reason for the claim of the solar flare from June 27 to June 30, 1908 is groups of spots on the Sun (No. 6465 in the Maunder Catalogue), which were active during this period, passed through the central meridian and existed on the western limb as well (according to the Newbegin's report at the Astronomical Society meeting in London) [German, 2007, p. 104; 2012b, p. 114]. In addition, Sun activity is confirmed by the photographs of the widening of the spot's iron line on June 27, 1908 [Hale, 1908a] and by the observation of a large protuberance of the Sun's limb on 30 June 1908 at the afternoon. Curiously or not, but in an article, published in the Philosophical Transactions in the year 1906 A. Schuster gave the times of maxima for sunspots of this period as being 1903.72+4.79. This would bring the maximum to 1908,51, or on 1 July 1908 [Schuster, 1908].

According to the consensus at the beginning of the 20th century, the air-glows during the Tunguska phenomenon had no spectra characteristic of the Polar Aurora. However, this is not surprising: in 1908 scientists were not yet able to distinguish the hydrogen emission lines of the proton aurora and even the most intense green line of atomic oxygen (5577 Å) (systematic measurements of the magnetic fields of sunspots had begun only in 1917 [Ringnes, 1961]). Perhaps the NLCs field having a continuous spectrum also prevented them from being registered (air-glows in Eurasia during of a proton flare could be initiated by the western drift of the ionospheric jet and spread from the Yenisei to the Atlantic; NLCs could give similar extension). In addition, for energy protons and electrons creating a diffuse aurora peak, the spectra are continuous. Protons penetration through magnetospheric 'fissures' [German, 2012b, p.118] explains geomagnetic pulsations in Kiel for three days before the Tunguska explosion as well. Although the airglows of June 30 — July 2, 1908, differed from the usual Polar Aurora in that through them stars were not always seen (in Heidelberg, Tashkent, etc.) and magnetic disturbances were not everywhere, there are reasons to suppose a 'soft' Polar Aurora with elements of the so-called 'black Polar Aurora' (it registering during the unusual proton aurora). Remind that eyewitnesses claimed about the black sector inside luminescences of the sky on 30 June 1908 [Schoenrock, 1908]. As a result, despite only twilight emissions with a broad diffuse spectrum like the extended twilight (that usually follow volcanic eruptions) have been registered, the bright skies during the Tunguska event in 1908 could have been connected to (1) the major luminescence of the 'soft' proton aurora [German, 2007, pp. 114-116; 2012b, p.118] and of the spread ionospheric phenomena as well, (2) the noctilucent clouds as the secondary luminescence; since NLCs could contain the heavy elements [Hemenway, 1973] it might point to the Sun as well [German, 2012a, 2013c].

Furthermore, geomagnetic pulsations are attributed to hydromagnetic waves, which propagate under the influence of various kinds of resonant systems in the Earth's space, and they are modified in a very complex way both by magnetospheric/ ionospheric currents and by the ground currents. Our previous studies showed that Pc5 pulsations observed by L. Weber in Kiel on 27-30 June, 1908 could caused also by infrasound waves propagating from the epicenter of volcano-earthquake preparation in the Kulik-caldera in Siberia during a night radon emission [German, 2007, 2008, 2009c]. The velocity of infrasound waves about 300÷330 m/sec well explains the difference in 15 min. between the explosion in the Kulik-caldera and the ending of the pulsations in Kiel on 30 June, 1908. It was shown that spread ionospheric phenomena before/by/ after earthquakes are caused by enhanced activity of acoustic waves with periods up to a few minutes, which propagate from the region of earthquake preparation up into the ionosphere [Liperovskaya, 2006]. In other words, we have the indirect confirmation of the appearance of the spread ionospheric phenomena during the Tunguska event.

5.7. The Allais effect during a solar eclipse

Let us remind you that the solar eclipse was observed on 28 June, 1908, from 13:30 till 19:30 UT (Fig. 8).

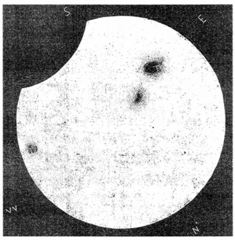

Fig. 8. *Sunspots during the solar eclipse on 28 June 1908.*

There are a number of reports about changes of a geomagnetic field caused by eclipses. Pulsations that were registered in Kiel had begun 20,5 hours before the eclipse and ended 29 hours after the eclipse. Hence we can suppose the correlations, secular or not, between the Tunguska event and the solar-lunar-terrestrial effects of eclipses.

Phenomena which have been repeatedly registered at solar eclipses have led to speculation that several effects may be significant for the alternative explanation of ULF pulsations in Kiel during the Tunguska event. They include (a) a generation of internal gravity waves for several days prior to and after the eclipse [Seykora, 1985], (b) some sort of a geomagnetic reverberation effect of hydromagnetic waves between the Earth and the Moon [Meisel, 1979], (c) a change of the gravitational constant because of gravitational shielding, (d) combinations of items (a)-(c).

During the solar eclipse of June 30, 1954, M. Allais registered effect of the changes in azimuth angle of the paraconical pendulum, or possibly changes of the gravitational constant [Allais, 1954]. This effect set in well before an eclipse began and lasted at least half an hour after it ended. However, a reduction in the Earth's gravitation instead of its increase in connection with the Moon shielded a part of Sun's gravitation was registered [Flandern, 2003].

In 1988, Fishbach's team, analyzing original Eötvös experiments, proposed a gravity-like 'fifth' fundamental force in nature [Fischbach, 1988]. According to the model 'a fifth force' would arise from the exchange of a new ultra-light boson which couples to ordinary matter with a strength comparable to gravity. 'A fifth force' is a repulsive force. Whether could 'speak' an Allais effect during eclipses about an appearance of 'a fifth force'?

A formation of a mascon (mass concentration) of 10^{11} kg inside an area of lunar umbra/penumbra at the altitude of 8,5 km during solar eclipses has been already supposed [Flandern, 2003]. Here is considered the gravitational effects of an increased density air mass spot due to the cooling of the atmosphere. Using same arguments we suppose that such mascon could have formed in the solar eclipse area (67° 9.2' W, 31° 26.7' N) on 28 June 1908 and has been apparently able to reach Siberia on 30 June, 1908, where it blew over the Kulik-caldera [German, 2008b]. Our hypothesis has a surprising correlation with results of recalculation for the seismic data [Ben-Menahem, 1975] where it has been shown that the Tunguska 'object' had a weight of 10^{11} kg, and that explosion has occurred exactly at a height of 8,5 km. Usual atmospheric tides probably have thermal rather than gravitational origin. By our previous statements [German, 2008b], the maskon, if it really existed, could be the effect of the anomalous tide in/on both the solid Earth and atmosphere on 28-30 June 1908.

5.8. The discrepancy of the Moon longitude; gravitation vortexes

In our opinion, the lunar-solar tide was one of the crucial factors for the Tunguska 1908 event. Lunar-solar tides related to the earthquakes because the important changes in tectonic eruptive behavior occurred usually close to the solstice and equinox. First air-glows of the Tunguska event began in Europe on 22 June 1908 and the explosion occurred just 8 days after the summer solstice. Obviously, lunar-solar tides have been increased due to the solar eclipse on 28 June 1908 [German, 2007].

We performed reconstructive computer calculations of a lunar-solar gravitational tide for the explosion's epicenter in Siberia (i.e., the Kulik-caldera) for 30 June 1908 and found that in this caldera the lunar tidal outflow occurred at the local time 7 h 10 min. (± 6 min.) a. m. [German, 2009a, Fig.1]. This time precisely coincides with the registered time of the explosion at this geographic location in Siberia on 30 June 1908 at 7 h 15 min. a. m. (± 5 min.). The anomalous gravitational tide could lead to changes in the terrestrial magnetic dipole and to trigger the tectonic activity.

Further, the Moon and the Earth orbit around a common gravitational midpoint called a barycenter, which is inside the Earth, about three-fourths of the way out from the center. Astronomers have always referred to the secular tidal effect as an acceleration of the Moon longitude. The discrepancy in the secular evolution of the Moon longitude (the big bump) was observed at the beginning of the 20th century (1900-1920). It is a historically old problem [Munk, 1960]. Remarkably, the period of time of the discrepancy in the Moon longitude includes also the year of the Tunguska event. For a solution of the Moon longitude discrepancy, it was supposed some minor changeability either (1) in the Moon's period or (2) in the Earth's rotation.

(1) By assumption of R. Dicke, the discrepancy is, at least in part, due to a variation in the Moon's period. He supposed that the Sun possibly emits scalar waves in a long-range, i.e., zero-mass chargeless, scalar fields [Dicke, 1964]. According to this hypothesis, the discrepancy in the secular evolution of the Moon longitude at the beginning of the 20th century was possibly caused by the Moon passage through a stream of scalar waves (about the history of scalar fields in connection with varying the gravitational constant see please in the 'Dictionary of terms' below). Periodic variations of the 'effective' gravitational constant with the lunar or diurnal

period have already been pointed out [Mbelek, 2002]. Furthermore, the version of the Kaluza-Klein theory, which includes an external scalar field, minimally coupled both to gravity and to the geomagnetic field [Carstoiu, 1969] had been defined.

According to the hypothesis of R. Dicke the variations in earthquake rates are interpreted in terms of changes of the gravitation constant. These changes could be caused by passing scalar waves [Dicke, 1964]. It is known that the frequency of the earthquakes has a maximum in mid-June when the Earth in an aphelion. A variation of the gravitational constant with a period of a sidereal year was supposed [Dionysiou, 1993]. The tilt of the geomagnetic dipole to the interplanetary magnetic field determines a point of the summer solstice. Indeed, before the Tunguska phenomenon, on 22 June 1908, optical anomalies in Europe sharply increased [Stenzel, 1909].

Record emission of seismic energy for all 20th century has been registered since 1905 till 1907 [Whitten, 1969]. Note that a tidal potential function had a maximum in 1908.5 and the next maximum was about 1956 [Dionysiou, 1993]. In 1957, 50 years after the Tunguska event three earthquakes, strongest since the year 1900, with 9.1 magnitudes occurred [Gutenberg, 1949]. Continuing the line of reasoning, we propose a new hypothesis: if scalar waves really exist then probably there is a correlation between their emitting and an appearance of vortical rotational structures on the Sun (with the nearly 50-yr period). Moreover, a question about the existence of scalar waves in connection with the Allais effect is open.

(2) Another possibility for the solution of the Moon longitude discrepancy is a change of the Earth's rotation axis in spatial position. Let's notice that for the last 250 years deceleration rate of Earth rotation underwent sharp changes. Irregularities in the Earth's rotation could be in connection with (a) Chandler wobbles of the Earth, or polar motion, (b) changes in the rate of rotation, or changes in the l.o.d. (length of day) [Munk, 1960]. The Chandler wobble is a motion of the rotation axis with respect to the Earth's crust. The l.o.d. mainly connected to the work done by the Moon [Lambeck, 1980]. It is proposed [Runcorn, 1972] that geomagnetic secular variations exert impulsive torques on the mantle and that these would perturb both the l.o.d. and Chandler wobbles.

Small cross-coupling, between both l.o.d. and Chandler wobbles, was found [Dahlen, 1976]. Possibly, currents in the

Earth's fluid core are reasons for fluctuations as of the l.o.d. and of the Earth's magnetic field as well. The satellite experiments, having defined the westward drift of a magnetic field, supports for this hypothesis (the problem of the Earth's magnetic field origin has not yet been finally solved). In our opinion, the anomalous gravitational tide (outflow) which occurred during the Tunguska event [German, 2009a] could have lead to fluctuation of Earth's magnetic dipole and, consequently, to a tectonic phenomenon [German, 2009c].

The theory of torsional oscillations in the Earth's core is developing, and an attempt is made to evaluate the associated geomagnetic variations using the assumption about a superimposition of a quadruple field on the main dipole field in the terrestrial core. This estimate provides a simple explanation of the reversals of the Earth's magnetic field [Petrelis, 2009]. We remind that a pole of the quadruple momentum of the Earth is located near the Tunguska area [Parkinson, 1983]. In addition, in Eastern Siberia an agonic line (zero declination) has an anomaly: western declination is observed instead of the eastern one. It is known that this line turned clockwise towards sub-latitude orientations from 1900 to 1920 [Vikulin, 2004]. The largest changes were observed in 1901-1909, especially in the Irkutsk-Krasnoyarsk region (i.e., an area of the Tunguska 1908 phenomenon) [Smirnov, 1910].

The effect of a mass transfer from the Southern to the Northern Hemisphere towards higher latitudes, and also a redistribution of the Earth's mass closer towards its axis of rotation probable caused an increase in free oscillations of movement of the Earth between 1906 and 1908 [Munk, 1960]. It was suggested [Courtillot, 2003] that hotspots moving in each hemisphere correlate with episodes in true polar wander (TPW) and are probably results of convection in the low mantle. It was reported [Kimura, 1909] that the amplitude of the vertical z-component of Chandler wobble growth specifically in 1907-1908, and possibly in 1909. An especially strong change in the movement of the North Pole for all the period 1907-1910 [Kotlyar, 1994] was recorded between 14 June and 2 July 1908, i.e. during the Tunguska event. There are numerous attempts to link variations in the Chandler wobble to earthquakes and volcanic eruptions. Probably susceptibility of an Eötvös force to change of gravitation by an amplitude of 20 mGal explains the effect of polar motion [Jeffreys, 1976]. The amplitude of 20 mGal accords well with a magnitude of lunar-solar tidal forces [Melchior, 1983]. In our opinion, this tidal force could increase pressure on the CMB/mantle, and thus as a result of heating and a minerals differentiation, there were mantle plumes activations under Siberia, Tasmania, etc. in 1908 (see 5.9 below).

5.9. Is whole-mantle convection the key to solving the Tunguska 1908 problem?

Day by day a slowly lifting of the earth around the diabase stones was registered in Tasmania from 7 June till 29 June 1908 [Scott, 1908; German, 2007, 2008a]. This uplift terminated in Tasmania as soon as the Tunguska blast took place on the opposite side of the Earth in the caldera of paleovolcano in Siberia on 30 June 1908 [Scott, 1908; German, 2007].

Fig. 9. *Scheme for the location of both the Cosgrove hotspot (near an area above the Pacific LLSVPs Anomaly) and the Tunguska Basin (near an area above the present-day/past Perm LLSVPs anomalies).*

The observations in Tasmania remained a mystery for a long time. Today, it is known that there is the planetary plume or so-called the Cosgrove hotspot from Eastern Australia to Tasmania (Fig. 9). This hotspot is the longest, 2000 km continental track, which had a volcanic activity between 33 and 9 Ma (according to [Davies, 2015]). However, in our opinion, the Cosgrove hotspot did not lose its activity fully 9 Ma because: (1) The Darwin crater in Tasmania originated about 803 ka [Lo, 2002], and the source of his primary origin has not been found. The total volume of ejected glasses in/around of this small crater is more abundant than it is observed in/around larger craters [Howard, 2003]. This contradicts to the impact paradigm [e.g., Grieve, 1992]. In addition, tektites were found near Gladstone town (north-Eastern Tasmania) [Chapman, 1963]. Let me remind you that the age of tektites-australites is considered equal to about 700-900 ka. Therefore, both the Darwin crater and tektites near Gladstone town originated probably due to the Cosgrove mantle plume/hotspot about 700-900 ka [German, 2019a].

(2) There were earthquakes in the predicted present-day Cosgrove hotspot location recently detected [Davies, 2015].

Hence, we consider the underground pressure of a mantle plume, i.e., a recent activation of the Cosgrove hotspot, as a cause of surface uplift in Tasmania from 7 till 30 June 1908 [German, 2019a, 2019d].

Two equatorial and antipodal areas on the core/mantle boundary (CMB), beneath Africa and the Pacific, are the regions of large low shear-wave velocity provinces (LLSVPs) [Torsvik, 2017]. Since they are antipodal, we attribute their formation to the result long-existing perturbances of subduction lithospheric slabs in the mantle/CMB by antipodal lunar-solar tides [German, 2009a].

Mantle plumes are mostly vertically generated above LLSVPs, but they can also be split into branches and tilted [Tsekhmistrenko, 2018] because they are deflected by background convection currents. Eastern Australia, from where the Cosgrove hotspot track began to move, is adjacent to the area above the western margin of the Pacific LLSVPs (Fig. 9). The present-day Cosgrove hotspot is in Tasmania due to the lithosphere thickness beneath Tasmania and as a result of either Cosgrove plume movements or the Australian plate over fixed plume [Davies, 2015]. In turn, the smaller isolated present-day Perm LLSVPs Anomaly (Fig. 9), identified beneath Eurasia, is proposed as a north-eastern arm of ancient Tuzo LLSVPs and as a trigger for the Siberian Traps (~ 252 Ma) [Torsvik, 2017, Fig. 1C] with centre in the Tunguska Basin (after that, the lithosphere was weakened here). The origin of helium-3 discovered in the epicenter of the explosion on Tunguska

[Alexeev, 1998], in our opinion, is also associated with the Perm anomaly, where He-3 has been in a primitive (not subjected to recycled slabs) state since the accretion of the Earth [Williams, 2019]. Moreover, according to flow models, the ancient predicted mobile Perm-like anomaly (i.e., the source of the present Perm LLSVPs Anomaly) had initial coordinates (~ 100°E, 60°N) [Flament, 2017] close to coordinates of the Tunguska 1908 explosion (~ 101°E, 61°N) [German, 2019a]. Therefore, we assume that paths of the mantle plum into the Tunguska Basin/paleovolcano in 1908 could be alternatively: (1) quasi-vertical return upwelling flows from nucleation sites of the mobile Perm-like anomaly due to slab remnants of the Mongol-Ochotsk Ocean lithosphere [Flament, 2017], (2) tilted/split paths from the present-day Perm LLSVPs Anomaly.

We suppose the Earth's hotspots chains may be interconnected because it has been argued that different volcanoes fed by plumes were activated almost simultaneously at the K/T boundary [Courtillot, 1990]. Indeed, during the Tunguska 1908 event brightest air-glows were observed over the Eifel volcano, and more weak one over the Yellowstone volcano (both volcanoes associated with hotspots). As the Cosgrove hotspot in Tasmania, moving mantle hotspots were registered in Eastern

Siberia as well [Rosen, 2015]. Hence, we suppose the link between the Cosgrove hotspot and Tunguska paleovolcano due to CMB/mantle perturbations on June 27-30 1908, and then upwelling of mantle plumes to the surface.

There are reasons to suppose that plumes under the Tunguska Basin and Tasmania are linked by a dynamical relationship and that they roots can connect via LLSVPs and the whole-mantle convection in the depth because tomographic models indicate that both under Tasmania and in the Perm LLSVPs Anomaly, present-day estimated mantle temperatures are close to each other at 2677 km depth [Flament, 2017, Fig. 1B]. Therefore, we suppose:

(1) the existence of a common magmatic reservoir of Earth's mantle, associated with LLSVPs, whereby all plums can be interconnected to varying degrees (if so, then since the thermochemical energy from this magmatic reservoir was released by the Tunguska paleovolcano explosion on 30 June 1908, the fluidal pressure of the Cosgrove plume under Tasmania was reduced, resulting in the termination of surface uplift on 30 June 1908),

(2) after the explosion in Siberia, displacements, as a 'domino effect', of three contacting tectonic plates - Eurasian, Sundaland, and Australian [DeMetz, 2010] - blocked the further

release of the Cosgrove plume conduit (i.e., hot gases) to the surface in Tasmania.

Meteorites could not cause the rise of the earth in Tasmania (astronomers observed the sky in the Southern Hemisphere, but no reports were received). Therefore, the meteorite impact hypothesis for the Tunguska event can be excluded.

5.10. Conclusion

According to our research, sources of the Tunguska event include the following.

(1) The anomalous gravitation tide in the Kulik-caldera of paleovolcano in Siberia on 30 June 1908, happened probably due to the discrepancy in the secular evolution of the Moon's longitude in 1900-1920. Especially the strong change in the movement of the Earth's the North Pole from 1907-1910 was recorded between 14 June and 2 July 1908, i.e., during the Tunguska phenomenon.

(2) The solar flare on 27-30 June 1908. It has been proven recently that the interplanetary magnetic field interacts with the geomagnetic field and causes it to oscillate in resonance with solar modes waves. As the Earth moves in the solar rhythm the changes of the geomagnetic field produce small detectable pulsations. Therefore, registrations of magnetic pulsations with

a period 3 minute in Kiel, Germany on 27-30 June 1908 can correlate with 3-minutes 'acoustic' halo of stellar (solar) flares. During energetic solar events (flares, etc.) disturbances of magnetic lines can perturb the main dipole field in the Earth's core (and/or in the layer D" of the CMB) and trigger mantle volcanoes activity by means convection of the LLSVPs.

(3) We prove that noctilucent clouds (NLCs) were not major luminescences during the Tunguska 1908 event and show that the 'soft' aurora after the solar flare, and/or the spread ionospheric effect, are responsible for observed air glows from 30 June to 2 July 1908. This conclusion is also confirmed by the polarization effect and registrations of geomagnetic pulsations in Kiel, Germany during the Tunguska phenomenon. Therefore, we argue that the concept of a dominating role of the NLCs in the mechanism of 'bright nights' can no longer serve in favour of the comet hypothesis for the Tunguska event.

(4) We suppose that a change in the rotation of the Earth (i.e. precession/inertia) due to the gravity of both the Sun and the Moon during/after the solar eclipse/flares (also possibly due the Allais effect and the formation of the mascon) in June 1908
led to the convection perturbations in the core/CMB/mantle, upwelling of mantle plumes and then the explosion of paleovolcano in the Tunguska Basin. This area is located above

the Perm/Perm-mobile LLSVPs anomalies. In the Tunguska Basin, the previous explosion occurred ~ 250 Ma, after which the lithosphere here was weakened.

(5) The underground activation of the Cosgrove hotspot in Tasmania from 7 June till 30 June 1908 that was terminated as soon as the Tunguska blast occurred in the caldera of paleovolcano in Siberia, confirms our conclusions. Since meteorites could not have caused the earth uplift in Tasmania, the meteorite impact hypothesis can be excluded.

Appendix B1. The Chelyabinsk 2013 meteorite and the Tunguska 1908 event

The Tunguska 1908 phenomenon had following characteristics [German, 2010a]: (1) for few days before explosion at the Tunguska area magnetic pulsations and displacement of sky polarization minima were registered, (2) for the first three nights after the explosion, skies of Eurasia were exceptionally bright, (3) the epicenter of the explosion is the center of paleovolcanic crater, which associates with the mantle plume, (4) the Tunguska site lacks important impact markers (5) despite enormous efforts of the expeditions, the main puzzle is the absence of remnants of space body in/on the ground in the affected region.

For comparison: the Chelyabinsk 2013 meteorite, which disintegrated higher than an assumed altitude of the Tunguska blast, left many remnants on a surface. However, the magnetic pulsations, the sky polarization anomalies, and the phenomenal continuous air-glows before or after explosion were not observed. Thus, there are no bases to claim that both phenomena were similar and the Tunguska event was an encounter of the Earth with a fragment of comet/asteroid [German, 2013a].

Appendix B2. No 'new evidence' for the meteoritic origin of the Tunguska event

It was asserted [Kvasnytsya, 2013] that investigated samples from the Tunguska area of the explosion are microscopically small remnants of a meteoritic body since diamond and lonsdaleite were considered to be products of the impact and other metallic phases such as troilite, schreibersite, γ-Fe, and taenite were described as a typical set of meteoritic minerals in the diamond-lonsdaleite graphite matrix.

However, we remind that: (1) the presence of aragonite and a light carbon reservoir [Sobotovich, 1985; Hough, 1995] indicate that terrestrial carbon graphite could be the precursor of the analyzed samples, (2) all nano-inclusions found in the carbonaceous matrix [Kvasnytsya, 2013] could be extended out from single grains of terrestrial troilite [Sobotovich, 1985], (3) the negligible content of Os and Ir in the carbon matrix [Kvasnytsya, 2013; Sobotovich, 1985; Hough, 1995] support their terrestrial origin as well. Thus, the article [Kvasnytsya, 2013] doesn't provide new proofs for a meteoritic origin of the Tunguska event, and alternative versions, e.g., an explosion of the Tunguska mantle paleovolcano during a solar flare on 30 June 1908 [German, 2010a-d, 2012, 2013b], still under debate.

Appendix C. The climate change and global warming

Recently, the Tunguska event was offered as an alternative reason for global warming since the Tunguska explosion coincided with the period when global warming began rising steadily during the twentieth century [Asher, 1997; Shaidurov, 2005]. However, it is likely that current and past climate change can not be attributed to unique isolated events as the Tunguska explosion [German, 2009d]. It is easy to prove that after 1908, and for almost a decade, the annual average surface temperature in the Northern Hemisphere decreased [Lamb, 1977]. Stratospheric temperature decreases associated with the Tunguska explosion were estimated in the range of 1-2°K. Temperature records indicate that during the Tunguska epoch, that is, in the decade after 1908, the Northern Hemisphere has been cooled by -0.3°K more relative to the Southern Hemisphere. Moreover, a loss of synchronism of temperature trends in both Hemispheres of the Earth was recorded during the first decade after the Tunguska 1908 phenomenon only. The similar changes in temperature trends were not detected during all other 10-year periods after the Tunguska explosion [Turko, 1982]. Thus, the calculated changes in temperature for the Tunguska event are comparable with temperature changes caused by activity from volcanic eruptions (e.g., methane, CO_2, dust, etc.) [German, 2009d].

Correlations between a continental volcanic/seismic activity and the climate cooling are well-known. For example, the period of highest average summer temperatures and most sunshine in central Europe, which was from 1942 until 1953, correlates with the minimum of finest volcanic dust (zero of previous 30-40 years) [Rudloff, 1967] (that also contradicts the hypothesis [Shaidurov, 2005] of correlations between the cooling and atomic tests since 1945).

Finnish geologist V. Auer revealed a sequence of layers of volcanic tephra in the Southern Andes during the post-glacial time and determined the periods of the waves of volcanic activity that took place on Earth [Auer, 1956]. Later this dating of volcanic waves by Auer has been confirmed for other areas of the Earth. The period of cold climate, i.e., the Little Ice Age, between about 1430 and 1850 also overlapped with the last wave of volcanic activity. The year 1908 in which the Tunguska explosion occurred belongs to the last wave of volcanic activity that according to Auer ended in 1915 [Lamb, 1970].

One of the reasons for the recent spread of noctilucent clouds might be global warming, but not vice versa as this follows according to some hypotheses (e.g., [Shaidurov, 2005]). It is considered that NLCs have appeared for the first time in connection with rising greenhouse gas emissions in the beginning of the Industrial Revolution. The years of maximum NLCs activity reports (1885-1965) were 1887, 1899, 1908, 1926, 1937, 1959, etc. [Fogle, 1966b, Fig. 2]. In the above-mentioned sequence of maximums of NLCs activity we can note two periods: the first is an 11-year cycle of activity of solar spots and, the second is the Saros-cycle (18.6-years) from 1908 to 1926. In other words, NLCs probably have a causal connection with the activity of the Sun (temperatures?) and of the Moon (tides?) [German, 2009d].

Worldwide waves of the increasing volcanic activity were brought about by stresses in the Earth's crust [Auer, 1956]. Possibly, this phenomenon associates with post-glacial isostatic movements and changes in the world sea level. We may remind: the total Arctic sea ice was rapidly increasing between 1908 and 1911 as well [Turko, 1982]. It means that there is no evidence to confirm the hypothesis of the alternative variant [Shaidurov, 2005] of explanation for global warming in connection with the Tunguska 1908 event [German, 2009d].

However, it is doubtful that only volcanic dust was a unique factor responsible for climate change. What additional factors can play an essential role? Is it due to an anthropogenic activity or other reasons?

Firstly, it is known that eruptions of submarine volcanoes/ earthquakes produce more greenhouse gases (CO2, etc.) than anthropogenic activity.

Secondly, we suppose [German, 2009d] that most likely, global warming which is observed today is correlated with the changes in the geomagnetic field. The Earth's geomagnetic poles are migrating. During the last hundred years, an excursion (an inversion) of geomagnetic poles that are possibly connected with processes on the Sun and with the changes in IMF is observed.

Thirdly, in our opinion, the important factor for climate change is the Forbush parameter, i.e., a 'competition' of influence on the Earth between the solar and cosmic (galactic) rays [German, 2009d]. When the loss of Sun activity was observed, galactic rays dominated, and global warming on Earth could increase (perhaps some role is played by the orbital cycles of Milankovitch as well).

THE DICTIONARY OF TERMS

S c a l a r f i e l d s − is the linear equations of the gravitational field were derived from Maxwell's equations using gravitational vectors instead of electromagnetic vectors. When Heavisidian monopoles are taken into account the equations can be changed by introducing two scalar fields. It was shown that the so-called vortex field of gravitational force comparable to the electromagnetic system. According to Dirac's hypothesis, Newton's constant is allowed to vary with space and time. In the Jordan-Brans-Dicke theory, there is a space-time scalar field that has the effect of varying the gravitational constant from point to point.

T e t h y s − is the relict ocean (palaeogeographic sea).

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