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# Plasmoid Phenomenon of "Cold" Earth Degassing (The Baikal Rift Zone as Illustration)

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**Abstract:** ***On the base of photo documents data of natural plasmoids in near the earth atmosphere over the actual degassing lithosphere structures of Baikal rift zone (active faults, mud volcanism latent form structures, thermal water sources), augmented with the experiments results, the existing of the plasmoid form phenomenon of the Earth "cold" degassing is proved. The prior investigators discussed this phenomenon at the level of hypotheses and assumptions. Various factors and plasmogeneration conditions in the lithosphere and atmosphere are considered. The morphostructural classification of registered plasmoids is made and their internal configuration features are discovered. The water phase transitions defining role in appearance and plasmoids structuring in near the earth atmosphere is shown. It is specified an influence of meteorological parameters on the plasmoids forming processes (temperature, pressure, humidity, precipitation).***

**Keywords:** plasmoid, degassing, plasmogeneration, atmosphere

## 1. Introduction

The investigation results of natural atmospheric plasmoids formations- the unique phenomenon, which is widely discussed in the world, are given in this article. They are known in mass media as UFO. In scientific world this phenomenon is defined of various terms as for: anomalous aerospace, anomalous luminous phenomena, geophysical meteor, earth lights, nocturnal lights, luminous balls, luminous flying plasmoids, optical geophysical objects, ogv, plasmoids, supermatters, cold plasmoids. In our article we use the term "plasmoids" as it defines the genetic gist of such formations, observed in the earth troposphere. Most investigators relate ball lightning to the plasmoids class too. The article authors are geologists by profession and they approached this phenomenon problem from different methodological perspectives than most physicists and geophysicists. The main attention was paid to the morphology, plasmoids internal structure, their space-genetic link with actual structures of the Earth "cold" degassing (tectonic faults, mud micro volcanoes, thermal sources). Besides, the authors investigated the climate influence and the seasons changing (winter, spring, summer, autumn) to the forming plasmoids quantity, to their structuring. Such phenomena characyeristics of plasmoids structures as direction, shifting velocity, life-time were fixed too.

## 2. Literature Review

### 2.1. Theoretical and experimental justification of plasmoid formations Genesis in the Earth bowels

A.A. Vorobiov (1970) expressed an idea about plasma-chemical reactors existing in the earth crust and appearing in certain areas where charges accumulating and electrical discharge processes can happen. According to his assumption, the glow and arc discharges in rocks pores can cause plasma-chemical reactions for chemical synthesis. Sobolev G.A., and Demin V.M. (1980) explain plasmoids appearance in the atmosphere during earthquakes as a result of deformational mechanical-electrical phenomena, taking place in the earth crust [81]. The conclusions of these researchers are consistent with the experiment results in the domain of mechanical emission and mechanical chemistry of solids [47], [55]. So, there is long ago known the glowings (triboluminescence), occurring when splitting or crushing of various mineral crystals. So, at the example of NaCl crystals it is shown that during their destruction the ionization waves are formed followed by mechanoluminescence [63]. It is defined that the cause of the glowing during crystal deformation and destruction are electrical discharges located in its splits and defective areas. And this is not by chance the anthropogenic plasmoids appear in surface atmosphere when carrying out industrial production of mirabilite in the Kara-Bogaz-Gol [55]. Mechanoelectrcal phenomena, generating plasma formations in destructive crust zones (faults, splits) follow seismic processes in periods of tectonic activity [51] The definition, given by Vernadsky V.I, to the phenomenon of the Earth „cold" degassing" as " gas breathing of the Planet" outlines its main feature – pulse (wave) nature of fluidal dynamic processes manifestation. Plasma state of substance has been regarded as one of the fluidodynamic systems attributes, forming the Earth autowave energy structure [24], [48], and the major crust faults - as peculiar fluidized capacitors, generating the stream of ionized particles and low-frequency electromagnetic radiation [49]. A.V Vikulin and T.Yu. Tveritinova [92] justify the wave nature of geological (geophysical) medium and existing of two new rotational types – slow (solitones) and fast (exitones) tectonic waves. This conclusion permits to correlate the pulse-wave nature of the Earth "cold" degassing, expressed in forms of mud microvolcanism and fractural tectonic with seismicity. For Baikal rift zone as an object of our plasmoids investigations the quasi-periodical faults activity changing is defined, and the magnitudinal (energetic) index of seismic activity is proposed for them. The short-period energy fluctuations of seismic events in separately taken faults were monitored in real-time scales [87].

### 2.2 Ether (vacuum) concept of natural plasmoids genesis

Researchers of this scientific field associate plasmoids appearance in the Earth atmosphere and near space to the

formation, transformation, physical structuring processes of the ether fields. From V.A. Atsukovsky point of view [14] carried out ether dynamic simulation, the plasmoids formation is associated with the system of moving toroidal rings and vortices stacked as amers (elementary ether volume) and forming respectively magnetic and electric fields. A.N. Dmitriev and V.L. Dyatlov [23] singled out a class of self-illuminating formations "cold plasmoids" in visible and invisible range associating their genesis with the existing of vacuum domains-energy forms (energofory). In contrast of mentioned before researchers, A.B. Bedritsky [15] considers the big plasmoids (UFO) as the supermatters, and the ball lightnings – as the midimatters. Herewith for the matters he understands true elementary matter particles, which are smaller of known physical elementary particles. The matters form the elementary particles and the ether. From them, gravitational, nuclear and electrical fields are formed. According to A.B. Bedritsky beliefs, supematters – this is a large number of compacted matters, and their small particles are called midimatters.

### 2.3 Investigation of natural plasmoids

There is a lot of publications of UFO specialists, commenting and summarizing occasional plasmoids observation by eyewitness or their own. With rare exception, the accuracy of these messages is low [72]. For this reason, we do not discuss them in our review and confine ourselves to review only scientific works, concerning in varying degrees the link of plasmoids formations with degassing structures and geophysical fields of the Earth.

#### 2.3.1 Monitoring investigations

During three years, the plasmoids were monitored by photo- and camera within environments of the Arenzano mountain (Genoa) and on the gulf of Genoa shore (the area of the fault) [16]. Filming took place primarily at nights and was accompanied by thermometric, magnetometric and radiometric measurements. Along with the usual plasmoids shapes – balls, hexagons, the unusual morphostructures, called creatures ("gryphosaurus", "neopterodactyls", "butterflies", "amoeba", "hooks") were found. Large variations in size of plasma formations were determined (from first centimeters to 500 m). Their high speed movement (up to 1500km/hour) in near of the Earth atmosphere is marked. According to Boccone [17] the creatures are the ether living beings. Hessdalen (area in Norway) [39] project research was carried out in 1983-1985. Then after ten years break, they were proceeded and are continued nowadays. Plasmoids observations were executed with the help of automatic cameras. Many photos were made by laser and infra-red cameras. Plasmoids formations of various coloring were fixed in the atmosphere such as having round, ellipse and complex (irregular) shapes. Unusual comet shaped (sphere-like with tail) plasmoids were marked too. Observation results are not still understood in full sense in genetic plan. They suppose that the atmospheric plasma takes part in plasmoids formation. The systematic recording of different by shape and size plasmoids, fixing them in visible (optical) and invisible (IR) spectra was fulfilled at Gorny Altai (Russia) above the tectonic physically tensed Katun-Terektinsky area [22]. Herewith the information about plasmoids movement velocity was obtained (1.2-1.8, 2.27 km/s), an energy concentration quantitatively evaluated in a separate plasmoid (1.0 W/m$^3$). Morphological types of plasmoids formations, represented by balls, hemi-sphere, quasi-spheroids, butterfly-shaped structures were also specified. On the publicated photos it is clear seen that pentagons and hexagons take parts in their construction. Despite the confinement of the plasmoids propagation zone to the energy active section of geology-geophysical environment, that is to the major tectonic fault zone [22], in submitted genetic model of Altai plasmoids (see section 2.2 of our article) there is not considered the decisive role of seismotectonics and degassing processes in their formation.

#### 2.3.2 Plasmoids above earthquakes epicenters

In scientific literature a great attention is paid to this class of plasmoids, called more often as "earthquakes lights". Brief description of many cases of plasmoids appearance before beginning, simultaneously and in consequent time interval after the earthquakes is given in the monographs [70], [81], provided with appropriate references to the literature sources of different years. Taking this into account we submit the published observation results of the plasmoids, the occurrence of which is associated with catastrophic earthquakes, that recently happened in Japan (near Kobe, 17 January of 2009, M= 7.2) and in Italy (Aquila, April 2009, maximum M=6.4). According to [91] data, before the first shock of the Japanese earthquake a white glowing plasmoid in shape of hemisphere appeared near the earth surface, which while moving up to the atmosphere was becoming orange one. The size of this plasmoid reached 100-200m and the glow duration was more 30 seconds. In the moment of the earthquake, flashes like lightning of the duration 1-3, 4-5 and 7-10s were fixed. All these plasmoids manifestations, forming a wide glowing zone (100-1000m and more), were fixed in the tectonic fault zone of 5-10km width. During this earthquake it was drizzle raining and over the earthquake epicenter a fog cloud of 2000x500m size was observed. With this in mind, the plasmoids formation is interpreted as a summary action effect of two factors [52]: electron mechanical emission from the destruction zone of tectonic fault and corona discharge of water drops. The Italian earthquake of 2009 is remarkable of what, that plasmoids appeared in a long time interval: the beginning – 9 months before violent shocks and the ending – 5 months after them [30]. These, along with the ball-like and conical morphostructures the white tetrahedrons were observed. A.K. Maslov with co-authors [58] created a mathematical model, describing conical plasmoids, observed before the earthquake in Aquila 06.04.2009. A new solution for the floating degassing stream taking into account the effect of giant combined light diffusion on micro-aerosol particles was put on its base. The authors believe that the shift of falling infrared radiation into the visible frequency range gives the visualization of degassing streams in the forms of light (plasmoidal) earthquake harbingers of various geometric forms. A.U.Olkhovatov [70] thinks that the reason of plasmoids occurrence associated with earthquakes, and the earthquakes themselves is a tectonic activity. However, with this he relates both these phenomena to different independent forms of it manifestation. Herewith, A.U. Olkhovatov doesn't deny the participation of meteorological processes in plasmoids formation.

**2.3.3 Plasmoids over the tectonic faults**

We mean the faults seismically less active then those, within the limits of which the catastrophic earthquakes are known (see section 2.3.2). To this type of generating plasmoids the ruptures, distruction zone of Hessdalen and Katun-Terektinsky test ground should be related (see section 2.3.1). V.A. Abramov [1] observed plasmoids spheres and discs in September 1997 in Amur gulf of Japan Sea over the Russian island and over the peninsula of Muraviev-Amursky (Primorski territory, Russia). Simultaneously with plasmoids in these areas, four tornados were registered. The author came to a conclusion that plasmoids are attracted or generated by the tectonosphere dynamic heterogeneities and at first the faults as it is marked their clear confinement to the deep seismo-dynamic energy iron generating fault. With this, he supposes that plasmoids formation due to emissions of ionized clumps from the deep bowels of the earth happens in wet electrified atmosphere.

**2.3.4 Plasmoids over mud-volcano structures**

**2.3.4(a) Mud volcanoes with dominate gas-explosive type of ejection**

According to literary data, the space genetic link of plasmoids is defined from the Tunguska (same "meteorite", "fireball", "phenomenon") and the Sasovo gas-explosive or cryptovolcanic structures [69], [70]. Upon the various eyewitness words, the Tunguska phenomenon of 1908 year was followed by giant abnormal atmosphere glowing throughout hundreds of kilometers, forming luminous balls transformed into the fire column. Some researchers consider it as a powerful explosion of plasmoid in the air, ejected from the Earth bowls not excluding with this the possibility of underground explosion [22]. Besides flying fireballs, some igneous white and color stripes, light straps, rainbow, igneous circles and cylinders were also marked visibly. According to A.U Olkhovatov [70] opinion, all these luminous formations are connected genetically with activation of Beresovsko-Vanavarsky tectonic fault. Geological investigations of the Tunguska catastrophe area specified a wide propagation of the actual mud-volcano structures in the form of craters, sinkholes, small valleys (upland and irrigated) [77], [78], [84]. Their sizes range from 3 – 100 m to 2100 m. The hypothesis about powerful explosion of nitrogen-hydrocarbon gases happened here the 30 of June 1908, came from bowels to the atmosphere was justified [84]. Similar the Tunguska, but small (diameter to 30 m) gas-explosive structures, generating pasmoids in the atmosphere are known at other sites: Sasovo area of Ryazan region (Russia), Spain [69], [70]. All these mentioned gas-explosive structures cause small local earthquakes with force about 4-5 points. To this plasmoids class we, presumably, refer light formations, followed by "meteroids" ("fireballs") like Vitim one, observed in various Earth areas [9], [70]. According to V.G. Peskov [71] opinion "… the exfoliating fireballs are proper to the oil-gas spaces".

**2.3.4 (b) Mud volcanoes with prevailing gas-water-lithoclastite type of the ejection**

This is a more common latent form of a "cold" Earth degassing. Its characteristic features: a weak manifestation of seismotectonic processes (earthquake force not more then 2-3 points), large growth of small (to 30-50 m) mud volcano morphostructures, short time, as a rule one act ejection of gases, (not seldom with burning), water-mud pulp. The small mud volcanoes appearance on the surface during day time happens generally unseen. Their life ends not seldom in formation of thermal and/or cold water sources. Mud volcanoes of the investigated type are formed both on land and on the bottom of the various ponds. Among the UFO specialists, these structures, from which, according to their data, the plasmoids, more often in form of spheres, "eject", are called as anomalous wells, holes, pits, bloody pits, holes, craters. The mentioned mud-volcanic morphostructures are widespread in oil-gas areas, for example, in Russia, on Taman, Yamal Peninsulas [73]. Their walls contain often signs of rocks and soils melting. Direct evidence of plasmoids formation simultaneously with mud-volcanic ejections are very seldom. Lets show, in our opinion, three true cases of such observation. The first one took place in the Dominican Republic at site near San-Domingo. Here the geophysicist Arthur Michelangeli fixed the formation of medusa shape plasmoid in simultaneously occurred mud-volcano crater[94]. The other fact is shown on the photo in newspaper "Russian Vestnik" (2007, № 21), on which we can see plasmoid ("Virgin", Bogoroditsa), of 0, 5x1, 2 m size close to the functioning mud-volcanic griffon creating small island on the water. The third one is illustrated as plasmoids photos [11], obtained in winter time on oil field of Tyumen region. They represent themselves glowing columns look like the trace of launched rocket, arising often over the continuously burning torches of associated gas. Some researchers indicate a big role of electromagnetic fields in formation of oil and gas deposits, supposing herewith the migration of hydrocarbons in the plasma state [32].

**2.4 Artificial plasmoids, obtained during physical experiments**

**2.4.1 The experiments using moisture**

V.E. Zuev with co-authors [98] when cooling high frequency discharge by water-drop aerosol stream obtained a long living quasi-spherical bright-orange plasmoid of about 0, 5 m diameter which moved with velocity 0, 5-1 m/s. These researchers consider this plasmoid as secondary formation, occurred in the result of primary plasma quick cooling by water vapor. Later by supplying water vapor into high frequency air plasma, generating in quartz flask they observed also the formation of cold plasmoids the life-time of which was 0, 5-5 seconds [75]. Besides quasi-spherical shapes, it was marked the appearance of complex polygonal plasma structures with "eyelash" type of shells. V.I. Lunev [53] carried out series of experiments, simulating the formation of natural plasmoids in near the earth atmosphere. Herewith the ultra-violet laser ($CO_2$-laser) radiation was used and the initiation of the earth surface layer periodic mechanic deformations using an electro-mechanical vibrator, a high frequency discharge in wet air. As a result, the plasmoids of quasi-spherical shape with diameter of 2-2, 5 cm were artificially created, living during 0, 4-5 seconds. The sphere like plasma structures of 4 cm diameter in atmosphere of fine aerosol were generated by erosive discharge [4]. Experimentally, in laboratory the secondary glowing and flying plasmoids (hydrated plasma formations) were obtained – the analog of ball lightning of 12-18 cm

diameter [25], [26]. Their moving velocity is 0, 6-0, 8 m/s to 1-1, 2 m/s. Gas discharge, induced over the water surface was investigated [82]. During electrical discharge the short living plasmoids of ball shape with concentrically zone coloring (white in center changes to circumference in yellow one, and then in red fringe. It is shown that air humidity increasing results in their lifetime increasing.

#### 2.4.2 Experiments without water component participation

In the experiments on investigating the energy-intensive plasma formations, obtained using pulse generators and initiated by erosive discharge, the secondary plasmoids of various configuration and morphology were fixed [4], [5]. At the exit of the discharge channel the glowing cylindrical plasmoids with pointed ends of 40 cm length and of 0, 6-1 cm diameter and also like irregular hexahedron, complicated with teeth were observed. Investigation of plasma clouds interaction at laser irradiation of two different targets showed that herewith the formation of spherical and crystal (hexagons and seven-gons) shape glowing plasmoids take place [7]. The artificial secondary glowing short-living plasmoids were found by N.V. Kosinov at a very far distance from primary plasma formation zone [46]. They are characterized by a complex form with teeth like comb and consist of linear fragments with regular geometrical configuration. While the primary plasma is structured in fraction representing itself the system of nested cones. Ending the literature review, we notice two common signs, proper to glowing plasmoids of natural and anthropogenic genesis: similar morphostructures and “secondary” origin. Those and others are the product of primary plasma substance, the origin of which can be very different.

## 3. Research Methods

The plasmoid structures observations were carried out at 9 sites (fig.1). Day and night monitoring with rare interruptions during 2007 (December) – 2012 was executed at test ground Medvedchikov Klyuch, located in the suburb of Ulan-Ude (side fault of Ude depression) within the temperature range of -35˚ C to + 28˚ C. All of them are differed by a various process intensity of actual bowels degassing. The table 1 shows two extreme cases: 1) with maximum fault activity and degassing processes (lake-swamp system of Kulinye swamps) and 2) Medvedchikov Klyuch test ground where the most weak an actual degassing was manifested. In addition to visual records (V-plasmoids) about 5000 photos were obtained by digital camera D-595 ZOOM and FE-250/X-800(auto mode in the hours after sunset till sunrise), that recorded eye invisible (infrared and ultraviolet wave range) formations (F-plasmoids). At observation sites the photo shooting of near the earth atmosphere over the actual degassing structures (tectonic disturbance, mud volcanic constructions, thermal water sources) was performed from one point in three different angles. Every angle is provided with 2 shots. This is due to the necessity of recognition on the photo of possible light sources of artificial origin (fires, fireworks, lights, radar, etc.), which in contrast of fast moving natural plasmoids, as usual are unmoved and repeatedly fixed on many shots. Plasmoids number, found at every observation site at the shooting moment was evaluated as an average value from 6 shots. At the test ground Medvedchikov Klyuch when making plasmoids photos a temperature and a pressure were measured too. The relative humidity values were submitted by the Buryat Center of Hydrometeorology and Environments Monitoring. Daily mean values of magnetic field and seismicity coefficient, used in the article for these parameters correlation study with the quantity of detected F-plasmoids are taken from the observation log of the geophysical station in Nadeino (SB RAS Geological Institute), situated 25 km far from Ulan-Ude city.

## 4. The Investigation Results

### 4.1 Characteristics of the actual degassing structures, generating plsmoids

*The test ground Medvedchikov Klyuch* is of 1, 2 km length and of 1 km width. It is situated on the part of the very active tectonic disturbance zone. (Fig.1) of Ude rift depression. It covers the North-Easten slope of small hill (point 699 m) built of cataclysed granites that, step by step pass to its foot into the thickness of mud volcanoes sand sediments crossed over by dried rill valley.

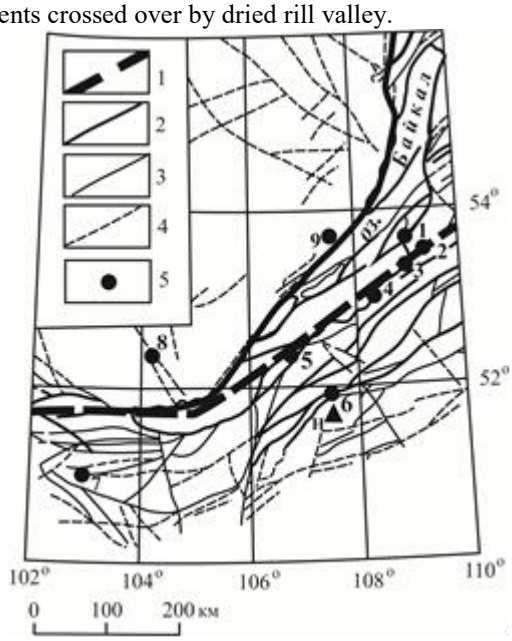


**Figure 1:** The observation sites of plasmoids structures on the map of Baikal rift system active faults [86].

1 - Zone axis of actual lithosphere destruction; 2- faults with the magnetic index of seismic activity (MISA)≥12 very active); 3- faults with MISA 10-11 (active); 4- faults with MISA 8-9 (weakly active); 5- plasmoids observation sites (1 – Kulinye swamps, 2 - Goosikha source, 3 - Ust-Barguzin, 4 – Goryachinsk source, 5 – coastal part of the Proval gulf, 6 – test ground Medvedchikov Klyuch, 7 – Khamar-Daban, 8 – Irkutsk, 9 – Zaminsky, N – geophysical monitoring station in Nadeino village (triangle)). Within the test ground the authors discovered about dozen of actual small mud volcano sandy-silt constructions (Table 1).

Over some from detected structures the small short time glowing gas flames and the simultaneously occurred quasi-spheroid and quasi-crystal plasmoids were fixed. In the field of these inflammations the burnt parts of the silt-sandy griffon deposits were found. When investigating them the

charred plant residues, spherical particles of native iron and glass, the fullerites (?), gypsum and calcite were identified. The observation site Kulinye swamps is represented by a fragment of the actual mud volcanoes constructions (Table 2.)

**Table 1:** The geologic-geophysical and hydrogeological situation of bowels degassing at the test ground Medvedchikov Klyuch (used data [33], [43], [74], [87]

| *Geographical position* | *The geologic-geophysical and hydrogeological characteristics of actual degassing* | *Gas-emanating structures* |
|---|---|---|
| The test ground Medvedchikov Klyuch on Ulan-Ude city suburb, South-Eastern line of Ude depression | Earth crust thickness is 45 km; Heat flow is 40 mWt/m²;Very active fault zone **(break)** bounding Ude depression with magnitude index of seismicity ≥ 12. The earthquakes of 8-9 energy class were registered 35-45 km from the test ground. The earthquake epicenters density – 7. The propagation area of underground cold radon carbon dioxide water. | Fragment of mud volcano structure, built with griffon sands of quaternary age. On the sand massive there are actual small mud volcano sandy-silt constructions: the cone shaped hillocks with the foot diameter of up to 0, 5 m and of the height of 0, 2-0, 3 m, funnels of 1, 0-2, 5 m diameter and of 0, 8-1, 7 m deep, the craters with ring mound of 0, 4-1, 5 m diameter and of 0, 3-0, 4m deep. |

**Table 2:** The geologic-geophysical and hydrogeological situation of bowels degassing at the Kulinye swamps site (used data [20], [33], [43], [74], [87])

| *Geographical position* | *Geologic-geophysical and hydrogeological characteristics of the actual degassing* | *Gas-emanating structures* |
|---|---|---|
| Lake-swamp system Kulinye swamps, Chivyrkuysky isthmus in Baikal eastern seaboard, South-Western termination of Barguzin depression | The earth crust depth is 40 km. The heat stream is 80-100 mVt/m². Very active fault (break) zone with seismicity index magnitude ≥ 12. Earthquake of energy class ≥ 13. Earthquake epicenters density-7. Underground hot water area, gassing N 2 and CH4. Grriffon-salsas functioning stage active phase of mud volcanoes ("hot point" of Baikal rift). | Two contiguous and partially overlapped the neogen-quatenary mud volcano caldera type structures of 7 and 4, 5 km diameters. More the 100 periodically gassing (N2, CH4, H2S) underwater griffon, of up to 5-7 m in diameter (temperature at the depth 0, 5m – 65-71˚C), The hydrotherms formation depth is 4, 9 km [], funnels of 1, 0-2, 5 m diameter and of 0, 8 -1, 7 m deep, the craters with ring mound of 0, 4-1, 5 m diameter and of 0, 3-0, 4m deep. |

It is situated in the very active zone of East-Barguzin fault, bounding the eastern line of the Barguzin rift depression. Aquifer rocks are granite-gneisses. *The Goosikhinsky source* is represented by two natural exits of nitrogen thermal waters with temperatures 43˚ C and 52˚ C and also the hole of 84 m deep which at the depth of 56 m opened granites. The hydrotherms forming depth is 5, 4 km [33]. It (spring) is situated at the axis of Baikal rift zone (BRZ) actual destruction. *The Goryachinsk source* of sulphate-sodium hydrotherms also like the observation sites Usty-Barguzin and the coastal part of Proval Gulf is coincided to BRZ destruction axis (Fig.1). The thermal water exit area is built of the Precambrian gneisses, amphibolites, granodiorites, overlayed by sandy-stones and sands up to 35 m depth. Water from the griffons (one is big with debit 13, 3l/s others are small periodically watering) form a pond. At the exit it is of the temperature 52-53 ˚C. Hydrotherms forming depth is 3, 7 km [33]. In the water gas composition a nitrogen dominates (99, 6 vol %). The content of carbon dioxide and methane amount to 0.2 vol.%. *The Proval gulf coastal area* of the lake Baikal is situated near the central part of the village Oymur. It is presented by a fragment (200x150 m) of the caldera type mud volcano structure represented by a field of numerous and closely spaced small (up to 2 m in diameter and up to 0, 5 m in height) griffon silt-sandy hillocks, covered by grassy plants. These structures appeared during two catastrophic earthquakes (the 31 of December 1861 and the 29 of August 1959). On the sandy edge of the shore we found the fragments of travertines and oil bitumen apparently occurred at functioning of underwater thermal sources in the recent past. The composition of free gas on Proval gulf coast is of a methane and a nitrogen. *Near the village of Ust-Brguzin* at the moment of photography on section of the Barguzin river sandy shore (200x100 m) in august 2009, small degassing funnels of 0, 2-0, 5 m diameter and of 0, 1-0, 2 m deep were marked. They, obviously, appeared several days before carrying out plasmoids observation, and failed to have been filled by sand. In the summer of the same year, according to the oral report of V.P Isaev (Professor, Irkutsk University), a significant part of the riverbed Barguzin was covered by dead fish. Upon his opinion it indicates a powerful release of gas (CH4 and N2) ejection. We also fixed numerous plasmoids in the village Ust-Barguzin itself, 100 m from Baikal. *Khamar-Daban site* is situated at a remote south-western flank of BRZ in a manifestation zone of actual, but less active then mentioned above observation sites, tectonic destructions (Fig. 1). However, here in a saddle on a ridge watershed we found an actual mud volcanic construction (10x8 m) of the Caldera type, laid on the Precambrian rocks of the Jidinsky ophiolite belt. Plasmoids are fixed near *Irkutsk city*, in an area of mud volcanic (griffon) quaternary age sands massive. In a dacha village not far from Irkutsk in the night of 7 to 8 August 2010, on a swampy terrain of about 15 m², 17 narrow holes with a depth of 30-70 cm (Fig. 2) occurred.

**Figure 2:** The gas jet exits to the ground surface (Irkutsk environments) in shape of holes

Herewith, the separate plant fragments near these structures were charred and oil bitumen was found in the soil. It is rather interesting the local manifestation of atmospheric plasmoids *at Zaminsky site*, where, literally on eyes, a cylinder structure of a mud micro volcano of 10 cm diameter and of 90 cm deep was formed. This natural "hole" on the earth surface had small rim (2 cm), laid by a silt.

### 4.2 Plasmoids configuration and forms

#### 4.2.1 V-plasmoids

At test ground Medvedchikov Klyuch their following forms could be observed: 1) the toroidal one with the outer ring diameter 6-7m; 2) the cone one; 3) the spherical one with the diameter to 1-1, 5m; 4) the triangular one; 5) the columnar one with the diameter to 30m. White, green, red glows of varied brightness are proper to V-plasmoids. Short-living (1-2sec.), small, of 10-30cm in diameter, spheroids were marked near the earth surface more often. Bigger and slowly moving in different directions plasmoid formations lived 5-6 seconds. The different direction velocity plasmoids movement is evaluated about 2-50m/s. The 22 of April 2008 penta-hexahedron glowing structures, including crenated one and curve-sided one, were detected (TERRa satellite space photos) on the Baikal ice in the area of the Cape Krestovsky and Nizhnee Izgolovye of the Svyatoy Nos peninsula of Baikal southern extremity [44]. The authors associate their appearance with gas jets breakthrough from mud-volcanic constructions at the bottom of the lake Baikal, discovered in the last 10-15 years. Similar to the Baikal ice one the degassing structure forms appear during permafrost melting in Siberia and Northern Quebec (Canada) due to methane emission [97]. However, we could not meet any published datas about a plasmoids genetic link with them.

#### 4.2.2 F-plasmoids

The entire set of the registered in Baikal region F-plasmoids by form and structure is grouped together in several types and sub-types (Table 3).

Cellular morphostructures of cloud-like (fig.3) and of torch types are compared with structures of a hydrodynamic "quasi-crystals" type [76].

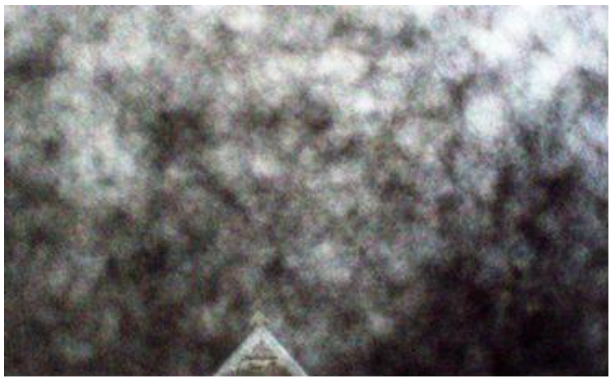

**Figure 3**: Cellular subtype of cloud-like type plasmoids above the Goryachinsk thermal water source exit (little hut is on the bottom part of the photo).

**Table 3:** Characteristics of F-plasmoid morphostructural types

| Types | Sub-types (specified sizes regarding to the landscape elements) | Forms, coloring, configuration features on photos(projection on vertical and inclined planes) |
|---|---|---|
| Cloud-like | Cellular (10x50m, 100x200m) | Grey clusters of fused polygons with mineral crystal face configuration of cubic syngony and of quasi-spheroids |
| | Non-ordered (1.0x2.5m, 3.0x10m, 70x100m, 100x150m) | Black-white striped one, violet and grey capelike one, spider like one |
| Torch | Cellular (0.7x1.5m, 3.0x5.0m, 5.0x10m) | The same as for the cellular sub-type of cloudlike type |
| | Non-ordered (0.5x4.0m, 1.5x5.0m, 15x60m) | Grey-white, grey cone, flame-like, columnar-shaped |
| Vortex | (1.0x2.0, 1.5x3.5m, 150x500m) | Grey, white and blue not even colored of vortex like configuration with right and left spirals, stitches, „eights" pieces (with toothed surface) |
| Quasi-crystal of simple forms | Polyhedral (3mm-30m, predominant 0.2-5m) | Isometric and elongated 3-, 4-, 5-, 6-, 7-, 8-, 9-, 10- triangles(general configuration) with one-three distinct expressed faces of the octahedron, the rhombic dodecahedron, the pentagon-dodecahedron. Often with a crenate (diedres) surface. A block-mosaic and a spot coloring distribution (green, blue, grey, violet, yellow and others) |
| | Polyhedral-striped (to 2.0m) | Consist of parallel and subparallel dotted, solid straights and wavy multicolored (green, violet, blue, grey) stripes inside of polygons |

| | | |
|---|---|---|
| Qasi-crystal of combined and complex forms | Comet like (0.2x0.6m, 0.15x0.7m 0.5-0.9x0.5-1.3m, 0.2-0.3x1.5-2.0m) | White elongated hexagons and rhombus with „tails". The tails are usually greenish-grey, striped. Isometric polygons are green-blue with violet spots, the „tails"are formed by blue and green stripes. The frontal parts of "comets" have a toothed configuration. |
| | Irregular polygons (0.2x0.3m, 0.4x1.0m, more often to 1.0m) | Concretions (aggregates) 3-, 4-, 5-, 6-, 7-gons in various combinations and quantitative proportions. A white coloring dominates. |
| Quasi-spheroidal | Uniform-colored | Translucent one with diffuse boundaries, round violet spots |
| | Zonal- spotty-colored (0.1-2.5m) | Concentrically zoned in combination with spotted coloring distribution (white, violet, green, blue, grey) They have toothed boundaries. |
| | Wave-shaped (1.5-5.0m) | Brown one of different shades, yellow with thin crenate surface. Crests of waves are emphasized with more intensive coloring. |
| Complex one of curvilinear shape | (3x5cm, 5x10cm, 0.3x1.0m, 0.4x0.6m, 0.9x2.0m, 1.5x6.0m) | Partially with toothed boundaries - white ameboid shaped, insect-like, of „eights" type, often with proboscis-like spikes – tubes. Tube section shape – oval and spherical. Tube coloring is not homogeneous (violet, green, yellow-green, dark blue) |
| Biomorphous, pseudomorphoses | | Glowing leaves, tree branches and insects (mosquitoes, butterflies). |

They are also remarkably similar to the gravity-capillary standing waves „patterns" (wave structures of quasicrystal type), composed with rectangular and hexagonal cells, obtained experimentally on the surface layer of liquid dielectric, placed in alternative electric field [59]. Similar cellular morphostructures are produced by detonating waves in bidisperse gas suspension particles of 2 and 1μm size [29]. Disordered plasmoids of torch (fig.4) and vortex (fig5, 6) types are similar to polar lights [27], some varieties of plasma-dust structures, obtained during experiments [31].

**Figure 4**: The disordered sub-type plasmoid of torch type. Test ground Medvedchikov Klyuch.

**Figure 5:** The vortex type plasmoid at the test ground Medvedchikov Klyuch.

Quasicrystal, of simple forms, polyhedral plasmoids have similarity or identification with polyhedral multilayered fullerenes [83], experimentally revealed by two- and three-dimensional ordered structures of heterogeneous low-temperature plasma solid macro- particles [68]. Structures selected in an irregular polygons sub type (quasi-crystal combined and complex forms type) are very similar (fig.7) to plasma cloud configurations, appeared during two-impulse laser irradiation of spherical and planar targets, cold plasma clots, generated in quartz flask when supplying water vapor to an air plasma of a HF-discharge [75].

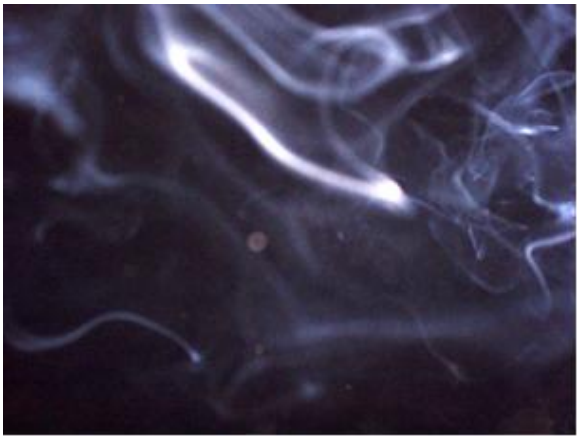

**Figure 6:** The vortex type plasmoid at the test ground Medvedchikov Klyuch.


**Figure7:** Quasi-crystal plasmoids in the background of the vortex one. Detail 1- close to isometric 7-gon. The test ground Medvedchikov Klyuch

Quasispheroidal plasmoids (fig.8) are characterized with crenate („massage ball" type) crystal surfaces of outer shells. The similar type – a neutral plasma („freezing plasma") morphostructural model obtained during laser cooling [42].

**Figure 8**: The Quasi-spheroid plasmoids with a crenate rim. The test ground Medvedchikov Klyuch.

A configuration study of several crenate zone spotty colored quasi-spheroids of 20-30 cm in diameter in zoomed photo projections, made at the test ground Medvedchikov Klyuch showed the following. The numbers of protruding teeth are almost the same (50-60 pcs). All of them, regardless the inner color range of quasi-spheroids, are on their rosish-grey coloring rims of the thickness equal to 0, 1 of the radius length. Teeth height, herewith, is 0, 3-0, 5 of the rim thickness. In some quasi-spheroid plasmoids the rim is changed by a concentric zone of small thickness (0, 03-0, 05 of the radius length) with a dark-violet coloring. We can meet quasi-spheroid structures with toothed surface, having a shape of "eights", composed with two jointed "massage balls" of an equal or different diameter, characterized by an almost identical inner structure. Their structure toward the center looks on the photos like: -a light-green rim of 0, 06-0, 09 radius thickness, with numerous small(to 0, 2 of the thickness) hardly distinguishable teeth; - a concentric light-rose zone of 0, 3-0, 5 radius thickness; - a spot-colored (claret-red, violet, violet-grey, grey-green colors), sized of 0, 5-0, 6 radius, margined with curve-sided (7, 8 and 9-gons) geometric figures. In a center of some "massage balls", making "eights" there are light grey with pinkish tinge and white 7-gons. "Eights" outlines form continuous rims and following them quasi-spheroids pink zones. Central spotty colored parts of the"massage balls" remain independent. More intensively manifested degassing structures at the observation site Kulinye swamps generate mainly, like creatures [16], not translucent white asymmetric bird- and insect-like F-plasmoids (up to 1, 5-6 m), referred to the type of complex curvilinear forms (fig. 9, 10).

**Figure 9:** An insect-like plasmoid ("a guardian angel" between the authors of the article).

The Kulinye swamps.

**Figure 10:** An unusual by shape plasmoid with "a proboscis", surrounded by glowing insects (biomorphous plasmoids-pseudo-morphoses). The Kulinye swamps

For a site with a lower degassing level (the test ground Medvedchikov Klyuch), quasi-crystal and quasi-spheroid morphostructures of colored plasmoids, ranslucent and not translucent are specific. Seldom met here not translucent white kinds are represented with comet-like morphostructures (Fig.11).

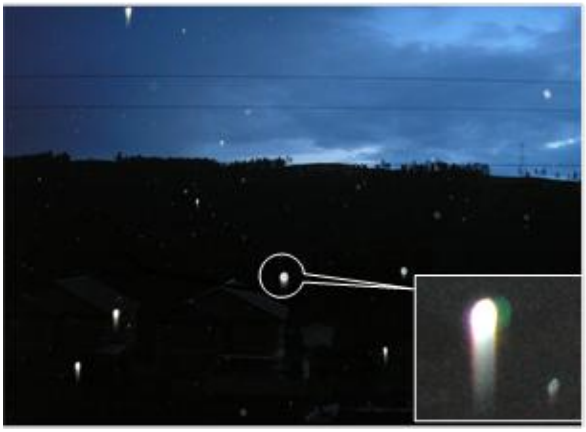

**Figure 11**: Comet-like plasmoids. Detail - an elongated smoothed 6-hexagon with "tail". The polygon contour is outlined with a stripe of violet and yellow coloring. On the head part of the plasmoid there is a green halo. The test ground Medvedchikov Klyuch.

In particular and poorly studied type biomorphic plasmoids-pseudomorphs (phantoms in the terminology of the UFO) are selected, represented by glowing pieces of plants and insects. (Table 3). Especially, they are widespread at Goryachinsk source and in the mud volcanic field of the Kulinye swamps. Unusual film-amorphous-crystal formations (0, 2-0, 5 cm; 0, 6x1, 0 cm;1, 5x3, 0 cm; 2, 2x2, 6 cm) apparently, mark "landing" places of plasmoids or obstacles, interrupting their moving. On the photos, they are not differed by a glowing and coloring from quasi-crystal F-plasmoids. Their structures consist of white, grey isometric and elongated 5-. 6-. 7-gons, localized on solid surface of different subjects (glass, wood) laid by substance films of up to 1, 5mm thick. It is defined that films consist of fullerene-like tubes, black spiral hair-like fullerites (?) of 2 mm x 4-8μm size, gypsum polyhedrons with toothed surface. Hair

ends are often split. A coloring distribution – zonal one, parallel to polygons edges.

### 4.3 An influence of climate, meteorological and geophysical factors on plasmoids formation

Quantity, sizes, morphostructural features, coloring of forming near the earth atmosphere plasmoids in varying degrees depend on seasons, weather conditions, temperature, pressure and humidity. At winter maximum minus temperatures (from -25˚C and -35˚C such plasmoids dominate: 1 – cellular sub-type of cloud-like and torch types; 2 - quasi-crystal and quasi-spheroid one with not clearly expressed borders shapes. There is a tendency of a plasmoids structures number growth during snow and blizzards (more 70-100pcs per one photoshot). White very small formations herewith are specific in the form of complex polygons. The bigger one are represented by quasi-crystal varieties (Fig. 12). In rainy weather, the number of plasmoids may be increased 5-10 times. Only in this case their dominate forms are ball-shaped and comet-like (Fig. 13). The correlation coefficient (r) between the fall-out amount and a number of F-plasmoids is +0, 31.

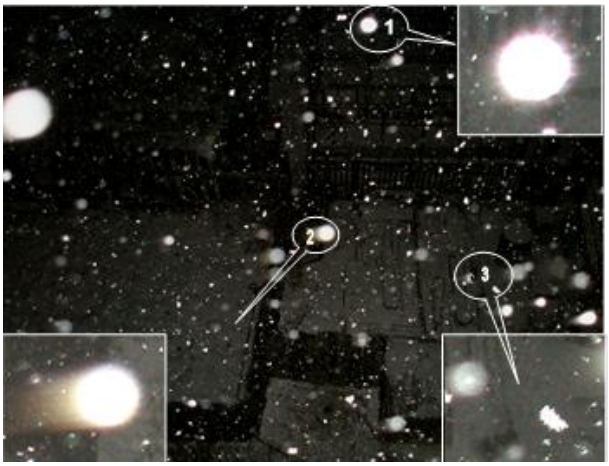


**Figure 12:** F-plasmoids, appeared during snowfall. The test ground Medvedchikov Klyuch.

1 – the white octagon with a round face and a white-violet crenate shell; 2 – the plasmoid in the form of a comet-like crenate hexagon; 3 – the aggregate of jointed polygons in the form of pentagon.

Average daily numbers of F-plasmoids are not correlated with seismicity and magnetic field parameters. Their weak positive correlation is observed with seismicity rate (r = +0, 38) when shifting three days ago. During spring months the atmospheric pressure prevents the F-plasmoids forming (r = -0, 44), and in June, on the contrary, encouirages their number growth (r = +0, 36). Atmospheric humidity increasing effects negatively in F-plasmoids number forming (r = -0, 23 for April-May and r = -0, 35 for June). It is remarked that, during strong wind and dusty storms near the test ground Medvedchikov Klyuch a significant number of F-plasmoids acquires a dirty greenish-gray coloring.

**Figure 13:** Plasmoids during raining at the test ground Medvedchikov Klyuch.

Daily and the time-lapsed dynamic of F-plasmoids number variations is characterized by a non-linear wavy (quasi-periodical) trend (Fig. 14, 15) as it is proper to deformational, electrical, magnetic and other parameters of the Earth wave field [24], and, in particular, to faults activation indices (seismic events) in Baikal Rift Zone [87].

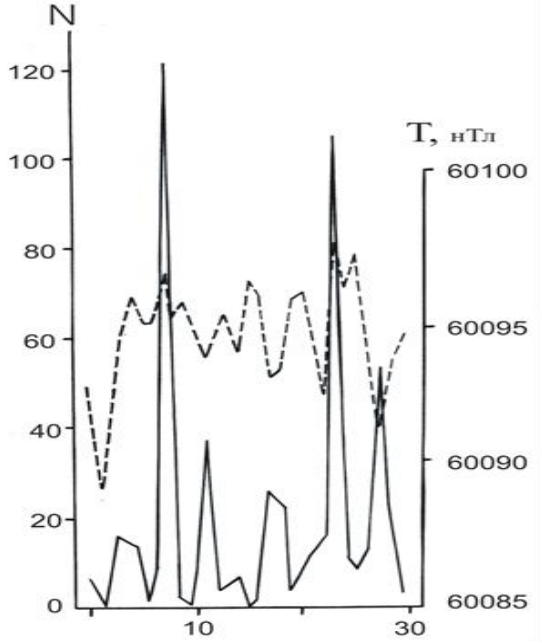


**Figure 14:** Daily F-plasmoids number (N) variations and a magnetic field strength (T) in April 2007 at the test ground

Medvedchikov Klyuch (T- values are according to the data of the geophysical station in Nadeino village, situated 30 km from the test ground).

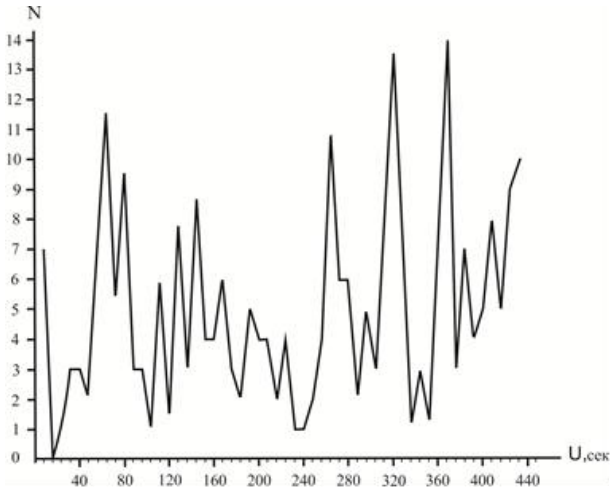


**Figure 15**: Quasi-periodic dynamics of a plasmoids (N) number change in the mode of continuous shooting (every 8 seconds – single shot) during 7 minutes and 12 seconds (U).

## 5. The Investigation Results Discussion

### 5.1 Geologic-physical and fluidodynamic conditions of a plasmogeneration in the lithosphere of Baikal rift zone

Plasmogeneration processes take place in two levels: endogenous lower one, covering degassing structures in the upper mantle and the earth crust; and in the upper exogenous one, represented their exits to the earth surface and also to a zone of rocks hypergene transformations (weathering).

#### 5.1.1 The lower plasmogeneration level

Degassing structures, generating plasmoids, are the result of the actual Central-Asian superplume throbbing activity [89].The BRZ is in central part of its habitat. The superplume appeared 15 million years ago. Now it determines the impulsive (quasi-periodic) forming processes character of basic plasmogenerating geologic structures in BRZ lithosphere: deconsolidation and tectonic disturbance areas, mud volcanoes ("degassing duct") and thermal sources. G.N. Cherkasov [89] associates the formation of hydrocarbon -Na, sulphate-Ca, Ca-Mg and Na underground water reservoirs, making a gas-hydrothermal system of mineral sources with the superplume mantle streams. Primary plasmogeneration foci simultaneously being centers of mud volcanoes origin (roots) occur in rocks destruction areas (tectonic breaks) as it is shown on the model [40]. Upon this model, a gas plasma „consolidates" solid, partially fused, mineral particles in them. Main plasma generating self-oscillating processes in the Earth crust are the deformational (electro-mechanical) one, probably with participation of mantle gas fluids, and gas-water-mud-volcanic one (electrochemical effects, electrization upon the model of „the vibro-boiling pseudo-fluidized bed" [90]). Along with gases (CH4, N2, H2, CO, CO2 at al.) and their plasma components in tectonically located rocks layers, i.e. in the mud volcanoes roots, a thin dispersed mineral component is formed [50]. This substrate, during its transit along tectonic ducts to the earth crust upper parts, while passing through the aquifer horizons makes gas-water-mud mash, aerosols and new formed plasma-dust structures (complex plasma by [64]). Indirect demonstrations of a plasmageneration lower level existing in BRZ are: - infra-red and radon anomalous radiations over tectonic faults, correlated with an endogenous heat flow [93]; - extensive development of the electrically conductive and the seismic waveguide layers in the earth crust [20], [43], [74]; - anomalies of HF-range heat radiation in lakes ice cover, serving as degassing indicators of mud volcanic constructions on the bottom of Baikal region many lakes [18]. S.V. Avakyan supposes that, a wide range of radio waves, including plasma-beam discharge radiation, can generate plasmoids.

#### 5.1.2 Upper level of plasmogeneration

It is characterized by different from the lower level plasmogeneration mechanisms, initiated at the exit of the lithosphere degassing structures to the ground surface. Here, plasmogeneration conditions sudden change takes place due to a number of factors: - hydrothermal fluids heterogenization with a gas phase separation;- deep recovered gases oxidation not seldom with their ignition; - underground water mixing with meteoric one; - aerosols different by composition; - electrochemical processes during a supergene transformation and rocks weathering; - climate changes; - biocenoses development.

On the upper level, in addition to the formation of the newly formed plasmoids in situ, a transformation, evidently takes place and primarily, a transient endogenous formations structuring, not accessed to photography. Due to a lot of enumerated exogenous factors we can suppose a significant number of mostly not studied plasmogeneration mechanisms. In BRZ actual degassing structures the upper level of a plasmogeneration, is mainly represented by three mechanisms of gas ionization: cavitational (during heterogenization of hydrothermal solutions on the spouts of water sources), oxidation gases reactions during the functioning of mud volcanoes, dehydration reactions and the crystallization of water sulfates, making deposits in crater mud volcanic lakes of BRZ. Let"s focus on the characteristics of the mirabilite dehydration mechanism, widely spread in lakes of Barguzin depression of BRZ, over the surfaces of which we fixed quasi-spheroid plasmoids during short time observations in the area of Alginsk group salty lakes. This mechanism was studied by Z.H.Gubaifullin and D.M. Mambetov[37]. It is found that, during the dehydration of the natural crystal mirabilite at the temperature above 30˚C in conditions of intense weathering, a plasma glowing occurs. It takes place as the result of a gas electric discharge phenomena initialization during the hydrogen and hydroxyl links destruction in the mirabilite structure. Spontaneous electric discharges were also observed in crystals of this mineral formed of water solutions in the process of their evaporation [56].

### 5.2 Plasmoids formation particularities in near the earth atmosphere

In BRZ atmosphere there is a number natural factors, which influence the transformation processes of primary lithosphere degassing plasmoid structures to the secondary one. In a certain conditions, independent newly formed plasmoids also occur which do not have any clearly expressed space-genetic links with tectonic faults and the structures of the mud volcanic type. To evaluate the role of

each of these factors is currently not possible. That is why we discuss below the most important, from our point of view, the plasmogeneration factors in the atmosphere lower layers.

### 5.2.1 The degassing influence to the plasmogenerating situation in the atmosphere

It is known that atmosphere-electrical parameters near the earth surface are defined not only by the weather conditions and by interaction processes of the atmosphere and the earth surface too [34]. The throbbing manifestation of BRZ lithosphere cold degassing in the form of a seismic faults activity, a mud volcanoes fluidodynamic functioning and a water sources gas-hydrothermal activity make main preconditions for the formation of the secondary and the transformation of the primary (lithosphere) plasmoids in the atmosphere. One of the main suppliers of the matter flows (aerosols, gases, water, dust, biorganics) and of the energy (electromagnetic infra-red radiation, deformational waves) from the lithosphere to the atmosphere are the tectonic faults. As the result of the earth electromagnetic fields effect on to the atmosphere over the faults zones, the line cloud anomalies [66] were formed. Some of geologists regards these destruction zones as the natural pumps of the fluids [62]. It is believed that in the earth crust stretching zones a fluids migration is mainly subvertical and in the compression one – lateral. It is defined that CH4 content in near the earth atmosphere over the tectonic disturbance 1, 5-2 times more than out of their limits [95]. A considerable part of the methane comes from mud volcanic structures.

With all the differences in the mechanisms of the structure-substantial and energetic influence to the atmosphere of each of the three BRZ actual degassing structures (tectonic disturbances, mud volcanoes and thermal sources) the following unites them. All of them form in the atmosphere a plasmogenerating system, consisted of gases and aerosols, intensively saturated with solid micro- and nanoparticles [6], [57], [66]. It is known, that the main electrization mechanism of atmospheric aerosols and their integral parts – cloud condensation nuclei - is an ion charging [54], [80]. Aerosol particles, herewith, bearing electric charges are able to absorb water vapor molecules what is of great importance for plasmoids structuring. We should indicate the electrization fact by salting of aerosols sandgrains (in BRZ – it is mainly a griffon sand of mud volcanoes subjected by a wind transfer), coming to the atmosphere [35]. Thus, salting mineral particles make a certain contribution to generation processes of atmospheric plasmoids. This is especially proper to salt (mirabilite) particles from lakes deposits of mud volcanic origin. So, according to the data [56], strong wind gusts accompanied by a salt whirlwind, transformed into the white sulfate storms, cause a strong ionization due to the sulfate portion electrization. These charged particles are moved by airflow to considerable distances in the atmosphere.

### 5.2.2 Lithosphere plasmoids when coming out to the atmosphere

The authors observed such plasmoids at the thermal water spouts of Goryachinsk source and at the test ground Medvedchikov Klyuch. In first case, they are represented as cloud-like cellular formations (see fig. 3) and semi-spheres, overlapping the wellhead with the gushing hydrotherms. Cloud-like cellular plasmoids at the height of 10-12 m from the earth surface start to decompose themselves and to be transformed into small quasi-crystal tetrahedral – hexahedral and quasi-spheroid (sometimes toothed) morphostructures. The cellular ("granular") plasmoids structure, as it is shown by the investigations of the complex helium plasma, obtained at very high frequency (VHF) discharge, is formed as a result of dust particles agglomeration (conglutination) [99]. The plasma clots stick at each collision with such particles. At test ground Medvedchikov Klyuch the lithosphere plasmoids at the exit to the atmosphere make, as would be dug into the ground glowing white columns, similar to Tyumen mentioned previously [11]. The direct evidence of immediate space-genetic link of these pillar-like plasmoids with degassing structures located in magma chambers roof of Elbrus "dormant" volcano is given in the work [38]. Here, the exit places of column-like plasmoids are fixed by thermal anomalies, periodic melting of a snow-ice cover, a vapor and H2S, aerosol clouds formation at near the earth atmosphere. We also marked exit places of lithosphere plasmoids to the ground surface in the form of small polygons, occurred during the snow cover melting at T= ─23˚C as a result of fluid steaming (Fig. 16).

Indirect sign of comet- or racket-like plasmoids flying out from the earth to the atmosphere is their vertical and sub-vertical position, "the tail" down to the ground, as shown in Fig. 11. Flying out from the earth plasmoids shapes are similar to microforms of conserved gas, gas-water inclusions in the ice of some mud volcanic lakes of Eastern Trans-Baikal. These inclusions structures are defined as "blackberry-like", "vase-shaped", "mashroom-like", "needle-like hexagonal" [19].

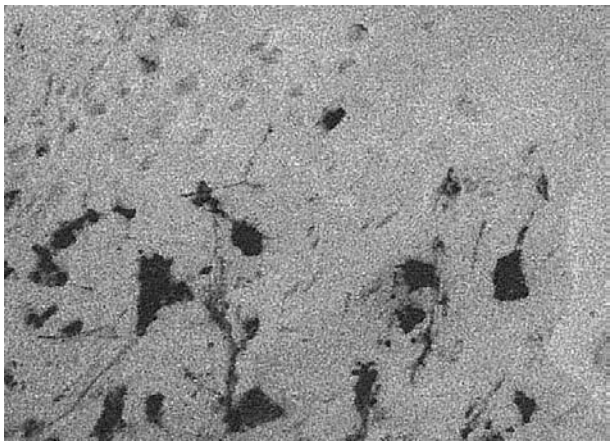

**Figure 16:** Exit places of plasmoids on the snow cover. The test ground Medvedchikov Klyuch (the size in the picture 2x1, 5 m).

### 5.2.3 The main factors of the formation and atmospheric plasmoids structuring

#### 5.2.3 (a) Aerosols

The investigated plasmoids form a continuous raw from mainly gas one to complex dust one (aerosols) characterizing by different quantitative components ratios. The plasma-dust structures consist of gas (ionized in varying degrees), charged dust mineral and organic particles, hydrosols and aerosols of "cold" degassing and Earth rocks

supergene transformation endogenous products. The composition of solid micro - and nanoparticles of atmospheric aerosols are very diverse. Along with insoluble mineral particles they contain water-soluble (sulfates, nitrates, haloids) and organic components. It is believed that the near the earth layer atmosphere is in General a weakly ionized environment, the electrical activity of which manifests itself in a quasi-periodic pulsations of the electric field caused by turbulent mixing of charged particles [8]. From our point of view, the bursts of such activity and plasmogenerating potential of the near the earth atmosphere are primarily determined by the local flow from degassing structure– bearing electric charges (aeroions) and plasmocontaining aerosols that form in the air space condensation nuclei. The experiments [79] with relative humidity increasing from 40 to 95% showed that on condensation nuclei an excess electric charge can be accumulated. Thus, nuclei with insoluble aerosol particles mainly have a negative charge, and with soluble (chlorides, sulfates, and other compounds) have the positive one. It is also established that the main electrization mechanism of atmospheric aerosols and their components – cloud condensation nuclei - is the aerosols ionic charging. We can confirm that originally charged aerosols of ground origin, received an additional ionic charge under conditions of air high humidity, i. e aerosols with super excess charges have an ability to form plasmoids in the atmosphere.

**5.2.3 (b) Water role**

Water – is a main component of near the earth atmosphere. Clouds contain it in different phase states, depends on air temperature. They are subdivided [21] into: 1) water, consisting only of drops (plus T˚C to – 10˚C); 2) mixed (T=— 10 - – 40˚C), represented by a mixture of supercooled $H_2O$ drops and ice crystals; 3) icy crystal (T≤ -30˚C). Water – is a very important factor of secondary plasmoids appearance in the atmosphere and especially in their structure forming, morphostructural features. Many investigators emphasized this. (See section 2 of this article). A.I. Mecenyashin [61] considers ball lightnings and atmospheric plasmoids (UFO) in the form of a frame – ice shell of 0, 01-100μ thick, consisting with ordered oriented water molecules in strong electric field. Even earlier they came to conclusion that a ball lightning contains a substance in a special state - in the form of a hydrated (cluster) plasma that differs from a normal one by water molecule presence [25]. AI. Grigoriev [36] submitted photos of glowing plasmoids appearing during storms near the water, snow, ice surface. He associates their formation with electrostatic unstable water drops and water films. Upon the opinion of this investigator, plasmoids are represented by corona discharges formed due to a photoionization near drops surface. His submitted photo is very interesting with small plasmoids on melting icicles having the curve-sided quasi-crystal outlines. In the experiments of effecting the $CO_2$ - laser nano - and microsecond radiation on the water droplets the appearance of the glowing within it is defined [10]. The appeared plasmoids has a reddish-orange color, a complex form and a granulated (grainy) microstructure, formed by vapor bubbles of 20-50μm in diameter, indicating the first kind phase transition, i.e. the boiling in the liquid. An intensive charging of cloud particles and the strong electric fields appearance (thunder clouds) in the atmosphere occurs during a collision of big icy particles with small one [65]. Thus, lightning discharges are generated and normal plasmoids sure to be. There are other formation mechanisms of the atmospheric electricity [41]: freezing, deformation and crashing of supercooled water drops; supercooled droplets spraying into big icy particles. In our opinion, a big number of atmospheric plasmoids are made during phase transitions of ice - water in the process of snowing, for example (see fig. 12). As G.S. Bordonsky [17] experiments to the study of a freshwater ice in a resonator showed that electromagnetic anomalies appeared during the ice heating to 0˚C and with it subsequent cooling to 0˚C at the frequency 6, 3 GHz in substrate where the ice crystals are divided by water. These anomalies are detected in the appearance of two waves with the same polarization and close wave numbers. For Baikal basin in sediments of which methane hydrates are developed, at the degassing process their dissociation into liquid (supercooled) water and gas takes place as it is shown in the experiments [60]. This mechanism may case a plasmoids formation. According to the cluster (quataron) model of the liquid water formation mechanism [12] hidden structured and unstructured phases are formed. The structured charged phase is formed by hollow quatarons in the form of the dodecahedron or the truncated octahedron containing 20-24 water molecules and also, solid quatarons of icosahedral forms made of 13 water molecules. Charged water quatarons structured similarly to coulomb crystals of complex plasma [31], [64], [68], form ball lightnings [13]. Thus, by A.M. Askhsbov [13] model, a ball lightning – it is a specific plasma in which electrically charged quatarons act as dispersed particles. To clarify a plasmageneraing ability of the ice-water phase transition the authors of this article carried out an experiment with melting icicles at the test ground Medvedchikov Klyuch and at Goryachinsk source. During the experiment some types, enumerated in table 3, of the morphostructures are obtained on small (5-6cm) ice icicles, exposed to 3-5% melting in room temperature (digital camera shooting at the distance of 20-40 cm). Sizes of the appeared quasi-crystal and quasi-spheroidal plasmoids including crenated surface, ranged from 1 to 4 mm (fig.17).

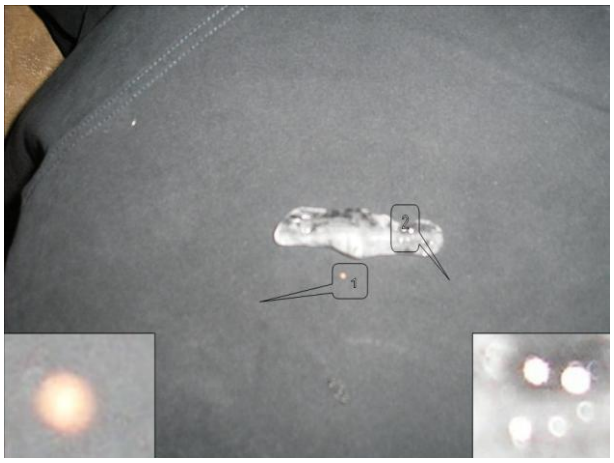


**Figure 17**: Crenated and zonal quasi-crystal plasmoids, located on the surface and near the melting ice icicle.

From published data analysis and our materials about a water role in a plasmoids formation in near the earth atmosphere the following conclusions are made: 1.

Plasmoids appearance is mainly due to phase transitions "water – vapor", and "ice – water". 2. Plasmoid structures are the most likely formed by a fractal self-organization of electrically charged clusters of a „hidden" water phase (quatarons) as it is shown in the ball lightning model [13]. Quataron forms, close to the quasi-spherical and quasi-crystal (polyhedral) cubic symmetry, are similar to coulomb (plasma) crystals. 3. A specific crenate plasmoids structure is due to the loose particles packing on the quatarons surface. 4. Quatarons form a thin molecular-crystal shell of plasmoids, which is able to keep plasma phase as it is supposed to ball lightning [13].

### 5.2.3 (c) Weather parameters

**Temperature**

It is known that the atmosphere temperature field is highly variable an heterogeneous over the degasing structures determining a large scale of water phase transformations in the aerosols and hydrometeors, as a result of evaporation processes, freezing, melting, deforming and splitting at collisions, sediments formation. Because of this, the normal air temperature measurements, made by the authors during plasmoids shooting, had not permitted to obtain the pattern of its high distribution values and define a possible correlation of this parameter with a number of forming F-plasmoids at the determined temperature levels. The existing data about integral temperature values near the earth atmosphere interval do not correlate with the F-plasmoids quantity. Our observations specified only the influence of the total air temperature on morphostructural particularities of appeared plasmoids (see section 4.3.) On the other hand, the temperature gradients, defining phase and structural water transitions are of a great importance in the plasmoids genesis and structuring. The results of some laboratory experiments with liquid aerosols and water solutions show this. From our point of view plasmogeneration temperature conditions at the exits from the lithosphere to the atmosphere in BRZ degassing structures – are determined by a higher heat flow (for example on griffon spouts of the hydrotherms sources). So, in the experiments with the drops evaporation of NaCl, ink, kalium dichromate [28] solutions the drying traces were obtained, outlines and inner configuration of which are similar to film-amorphous-crystal formations of "landing " areas and many zonal quasi-spheroids and quasi-crystal F-plasmoids types. The analogical concentric-zonal morphostructures ("Liesegang rings") were also found during the experiments with gelatin and AgNO3 solution [88]. If pure water drops were overheated, hexagons with inner cellular structure were formed as in cloud plasmoids we fixed, and in solution drops – curve-sided hexahedrons with solid and thin crystallohydrate shell [67]. Many investigators mark the electromagnetic radiation appearance including the radio band, when freezing different liquids.

**Pressure**

In 2003-2004 and 2007-2008 years the deep-water measurements of the electric field vertical component had been carried out on the base of a surface-bottom in the lake Baikal [45], i.e. on the territory, which is characterized with the highest level of the actual "cold" degassing manifestation in BRZ. Their result is a non-linear link detection of the convection current vertical component (Ez) variations with an interannual variability of meteorological activity, the atmospheric pressure including (P). The correlation coefficient (r) values, herewith, characterizing quasi-periodic correlation function P and Ez make a wide range (from -0, 1 to +0, 65). The correlation coefficient maximum is observed when delaying Ez regarding to P for 37 days. The reason of this remained outstanding and not discussed. For plasmogenerating structures of the East-European platform actual degassing it is established a high negative correlation (r = - 0, 82) of subsoil radon volume activity average values with the atmospheric pressure values [85]. Comparing the submitted literature data with ours the near the earth atmospheric pressure role in plasmoids formation of BRZ seems to be contradictory and not enough clear. As mentioned before (see section 4.3) there is a weak linear correlation between the plasmoids number and the pressure values – negative in cold period (spring months) and positive in summer. This can be explained like following. In spring, intensive phase transitions on the earth surface take place (snow-water, ice-water, and water-ice), electrifying the atmosphere and forming plasmoids formations. The atmospheric pressure growths, obstructing phase transitions, suppress a plasmogeneration, respectively. In summer months, in the atmosphere and the earth border, where a liquid water and water containing aerosols dominate, P values growth helps to the atmosphere plasmoganerating ability. Presumably, it is due to water phase transitions and a downward accumulation of diffused charged nuclei of a cloud condensation in near the earth troposphere layer also. It is possible too that the pressure plays role of a brake, making to change scales and forms of plasmoids structures, as shown in the experiments [3].

**Humidity and precipitation**

Unlike the experiments using the humidity (see section 2.4.1), proving the strong positive correlation with its content in the air and a plasmoids number, our observations, on the contrary, indicate a weak negative correlation (see section 4.3) of the relative humidity values and a number of appeared F-plasmoids. In our opinion, the negative values of the correlation factor can be explained by an effect of the following lithosphere degassing features, initiating plasmogeneration processes in near the earth atmosphere of BRZ, followed by the relative humidity decrease: 1) high values of the heat flow, drying the atmosphere; 2) restored gases oxidation (mainly CH4 and N2) due to the partial absorption of the atmospheric humidity.

As it was shown before, the atmospheric precipitation in the form of a rain and snow causes the avalanche-like plasmoids formation due to the powerful manifestation of water phase transformations and a cloud condensation charged nuclei formation.

## 6. Conclusion

The example of V- and F- plasmoids years research in near the earth atmosphere of Baikal rift zone showed the validity of published before hypotheses and assumptions about an existence of natural phenomenon that we named "plasmoid form (phenomenon) of the Earth cold degassing". Main conclusions from firstly carried out the monitoring

investigations on the BRZ territory from several days to 5 years duration are formulated as follows. 1."Cold" degassing plasmogenerating structures formation, represented by unconsolidated areas, tectonic faults, latent forms of mud volcanism manifestation, ground and underwater thermal sources is the result of the Central-Asian superplume impulse (quasi-periodic) activity. 2. The degassing forms three plasmogeneration levels, characterized by different prevailing formation mechanisms (further in the brackets) and plasma substance structuring: lower endogenous – lithosphere (deformational or mechanoelectrical); upper exogenous –lithosphere (gases oxidation, cavitation, dehydration and sulfates crystallization); atmospheric (phase transitions "water-vapor", "ice-water") where plasmoids sure to be formed due to the fractal self-organization of "hidden" water phase charged clusters – quatarons. 3. By the shape and the configuration the diversity of the photographed F-plasmoids are grouped in 8 types, most of which are divided into subtypes 4. F-plasmoids number variations daily and time-lapse dynamics is characterized by non-linear wave (quasi-periodic) trend, similarly to the characteristics variability of the deformational, electrical, magnetic and other parameters of the lithosphere degassing structures. 5. The quantity and plasmoids structuring processes, appeared in near the earth atmosphere are effected by meteorological and climate factors.

## 7. Other Recommendations

The authors research experience of the Earth "cold" degassing plasmoid phenomenon allows to make some considerations for it further investigation and also to outline the perspectives that this opens up. The study of the considered phenomenon can be fruitful only with the monitoring typesetting of research at special test ground (the actual degassing areas) during not less one year with that to cover all seasons (winter, spring, summer, autumn). Investigations should be complex and carried out by a group with specialists of various professions (geologists, geophysicists, geochemists, hydrogeologists, physicists, meteorologists). It is necessary to implement the synchronous observations on the ground and in near the earth troposphere, using advanced equipment for various purposes (from thermometers, gas-analysers and cameras to seismographs, magnetometers and geo radars) capable at the moments of photo shooting to register degassing parameters values (heat flow, gases contents, seismic, electromagnetic fields and others) and weather conditions (temperature, humidity, pressure, precipitation, wind) in near the earth atmosphere. Taking into account a quasi-periodic degassing manifestation character and plasmoids generation, the registrations results analysis and interpretation of instrumental observations we recommend making on the basis of parameters values time series periodograms using the wavelet- analysis the method, as shown in the example of the radon emanation from tectonic structures [85]. Linear correlation factors values, given in our article do not reflect the links cyclicity, and give only an understanding of the parameters variability some trends. The need for different countries scientific circles wide involvement to large-scale research of considered in the article the phenomenon is dictated by the prospects of fundamental knowledge gaining and the opened opportunities to solve some very current for humanity practical objectives: - a new promising approach to the life origin problem; - "plasmoids traps" creating and their energy transformers to required shapes for practical application; - catastrophic earthquakes short-term prediction. So, plasmoids monitoring investigations on the test ground Medvedchikov Klyuch allowed us to predict for 3 days before two earthquakes with a magnitude of 4 points in Ulan-Ude (21 of May and 27 of August 2008). Geophysicists-seismologists in Ulan-Ude were informed in advance about earthquakes time. In Buryat newspaper "Number one" (№22, 2008, p.8) there are comments about one of the prediction (the earthquake 21 of May 2008); - methane explosion prediction in mines, producing coal; - neutralization (liquidation) methods development of tornado and other types catastrophic tornadoes.

## 8. Thanks

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## Author Profile

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**Yalovik Lubov** from 1991 to 1996 – senior researcher of Irkutsk University. Within the period of 1996-2001, she works on gold themes in private firms and in the Chita Polytechnic University. In 1998 she received the candidate of sciences degree on the ore specialty in the Chita Polytechnic University. Since 2001 – senior researcher of the Geological Institute of the SB RAS geochemical laboratory, where she has been working nowadays. She is a specialist in the areas : geology of ore deposits, petrography and mineralogy of rocks and ores, bacterial mineralogy