SCIENCE WITHOUT BORDERS. Transactions of the International Academy of Science H & E. Vol.3. 2007/2008, SWB, Innsbruck, 2008 ISBN 978-9952-451-01-6 ***ISSN 2070-0334***

GLOBAL CLIMATE FLUCTUATION AND CYCLICITY OF THE VOLCANIC ACTIVITY

*Khain.V.E, **Khalilov.E.N
*Moscow State University named after M.V.Lomonosov,
**International Academy of Science H&E (Austria, Innsbruck)

The arguments of the international experts and various scientists on the causes of the global climate fluctuation were analyzed. On the basis of the study of the cyclicity of volcanic eruption of Earth the conclusion on the important role of volcanic activity on the global warming was accepted. The researches show that, the increase of the activity of the magmatic volcanoes results to the elevation of the concentration of the volcanic gas in the atmosphere. In the result of it, the greenhouse effect which brings to the global increase of the temperature of the atmosphere of Earth strengthens.

INTRODUCTION

In later years the big attention directed to the problem of the climate fluctuation. The special expert structures of UNN came to the conclusion that, during the last centuries the main cause of the global fluctuations of the climate is the technogeneous activity of the mankind. Nevertheless is it the main cause of the global warming?

At the first half of December 2007, in Indonesian island Bali was held the next conference of the parties of framework convention UNN on the climate fluctuation. In Bali conference the solution of the matters on the determination of the future of the climatic process were waited at the first place. The key points of the agenda were two points:

1) The long term cooperation on the solution of the problems
2) The future obligations of the developed countries in the framework of Ciot protocol. The compromises were found, the correlated solutions were accepted, but the future of the climatic process still maintains unobvious.

The deep causes of the indefiniteness regarded with the history of the international relations on the stabilization of the climate, also alterations of the anthropogenic refuses of the greenhouse gas in the global structure.

We decided to submit short reference. The framework convention of UNN on the climate fluctuation was made in 1992 in response of scientific evidences which stated that, the global climate fluctuation determined with anthropogenic alterations in content of the greenhouse gas of the atmosphere. Line of the results of the warming, especially the increase of the frequency of the extreme weather demonstration, the ablation of the mountainous glacier, the raising of the ocean level negatively influenced to the condition of the natural environment and development of the society. The long term purpose of the Convention was proclaiming the stabilization of the concentration of the greenhouse gas of the atmosphere in the level which will not make the dangerous anthropogenic influence to the climatic system of the world. The key form of the activity on the softening of the climate fluctuations accepted as the limitation of the anthropogenic refuses of the greenhouse gas (hereinafter the term “the

measures of the easing" will be used correspond to the activity which is regarded with limitation of the emission of the greenhouse gas and strengthening their absorption for ex. In planting of the forests). Therefore the emission mainly regarded with combustion of fossil fuel which is the main power resource in the modern world. This kind of the long term goal of FCCFUNN inevitably shall reflect to the development of the world economical system.
The main element of the Convention became the principle of the common but differential responsibility. All countries divided in two groups: developed countries (European countries, USA, Canada, RF, Japan, Australia, New Zealand) and developing countries. The full list of the developed countries stated in Annex No 1 of FCCFUNN. According to the convention the countries which were included to Annex No 1 shall take active part in struggle of climate fluctuation and its negative results. Beside the limitation of the national refuses of the greenhouse gas, provision of FCCFUNN obliges the developed countries to supply the financial and technological resources to the developing countries for the easing measures, for the more considerable vulnerable countries the adaptation to the climate fluctuations. The countries which were included to Annex No 1 realizing the transmission to the market economy (as well as Russia) the definite degree of the flexibility in the implementation of their obligations was submitted.

The majority of the provision of FCCFUNN formed in the common order, their detailing realize with the decisions of the annular conference of parties of FCCFUNN. These decisions became the juridical compulsory for the countries-participants in FCCFUNN. The first conference of the parties was held in 1995 in Berlin, the conference of Bali became 13^{th}.
The Kiot protocol to FCCFUNN was accepted in 1997 for the hardening of the obligations of the developed countries. The protocol has limited period for the implementation (2008-2012) and states for every country the severe defined quantities of the refuses to the end of the period. So the emission in 2012 shall be 93% in USA, European union -92%, 100% in Russia. By Kiot protocol the financial mechanisms which assist in the implementation of the obligations of the developed countries were introduced. Especially in the trade of the quotas on the refuses, mutual implementation, the pure development. (The essence of the trade on the quotes submit to the countries which are not able to realize their obligations on the protocol to buy the quotes from the countries which are implemented their obligations. The projects of the mutual implementation will realize among countries which are included to Annex No 1, in this case the country which makes the investment gains the right on the limitation of the emissions that is the result of the project. The mechanism of the pure development will use in that case when the country of the project will be the developing country).
In order to take the effect the ratification of Kiot protocol among countries-participants was necessary. The ratification of the protocol by the developing countries passed with success. In the developed countries the process was going on hardly. In 2001 the republican administration of USA declared the rejection on ratification of Kiot protocol. After USA followed Australia, however currently the position of the country changed. During Bali Conference Australia declared about ratification.

We, in no way set the task for the involvement to the controversy with the expert structures of UNN regarding with adopted conclusions by them. Our goal to show that, not only the anthropogenic activity of people negatively influence to the natural environment, in

this case we shall note the role of the endogen geological processes which also negatively influence to the climate fluctuation in worldwide level. Summarizing the long term researches on the investigation of space-time conformity of the volcanic and seismic activity of Earth it is very hard for us to avoid from the expression that currently observing climate fluctuations, especially the global warming in more cases arise on the background of the activity of the magmatic volcanoes, the lines of Earth oblateness which maintains this tendency during last 2 centuries.

In writing of the present article the materials of the report (2007) of the intergovernmental commission on the climate fluctuations were used.

So, on the basis of information of IPCC, in 2007 the concentration of CO_2 at the atmosphere was 380 ppm. Every year the activity of people increase the amount. Some scientists-climatologists and economists David Shtern and James Hansen consider that the concentration in 450 ppm –maximum permissible value.

In XX in the natural run of the nature processes involved the influence of the humanity which was notably in ice-borne sediments. The anthropogenic concentration of nitrates and sulphates is increasing: during 100 year the content of anions in ice SO_4 increased in three or four times, from 1950 began to increase the concentration of NO_3, presently the concentration increase two times in the result of transport emissions.

However according to the opinion of IPCC the main influence to the climate is the greenhouse gases: CO_2, CH_4, NO_2 and freons. The detail observation of the concentration of CO_2 at the atmosphere during long years conducted at the observatory of Mauna-Loa (Hawaii islands) and at the south pole. On the basis of the facts, from the beginning of XIX century to 80s of XX it increases from 285 ppm which is typical for the interice-bornes conditions, to 335-338 ppm, there is no analogs in the data of holes at Vostok station. The modern concentration of methane at the atmosphere equal to 1.7 ppm and 2.5 time more than maximum which is detected at the area of Vostok station (IPCC, 2007).

If we will compare the current concentration of greenhouse-gas with definite in ice-borne kern for the industrial time it became clear that, during last two centuries their increase consist of 25% on CO_2, CH_4 -100%, NO_2 -8-10% (IPCC, 2007).

The last indications correlated with data of the scale of combustion of the mineral fuel, however the common rate of content of greenhouse gas at the atmosphere –with increase of the population –from 1 billion to 5 billion people. It means that, namely the increase of the population bring closer the humanity to the ecological catastrophe (IPCC, 2007).

Actually ice-borne-intericeborne fluctuations test in itself the influence of the quick-feedback, conditioned with existence of water steam at the atmosphere, cloudiness, the snow cover and marine ice-borne, as well as more longer slow alterations in the structure of the atmosphere, it transfer the cold condition of the ice-borne epoch to interice-borne. In order to understand the mechanism of these processes should research the sensitivity of the global climate to the fluctuations of the concentrations of the greenhouse gas (IPCC, 2007).

It is known that, warming of earth cover under the influence of anthropogenic factors during last century consist of 2 Vt/m2, in future the doubling of concentration CO_2 in the atmosphere (from 300 to 600 ppm) it can reach 4 Vt. It seems that it is not so much in comparison with the average stream of the absorbed sun radiation equal to 240 Vt/m2. This value also will

result to the increase of the surface temperature 1.2 C. Taking into consideration the stated effects of the feedback the common warming may be considerable. The modern measurement is 2.8-5.2 C (average 4C). This is three time more excluding feedback relations. However, namely this value defines the sensitivity of the climate to the increase of the concentration of the greenhouse gas (IPCC, 2007).

By this way during the last climatic cycle the contribution of the greenhouse gas to the alteration of the temperature in Central Antarctica may fluctuate in the frame of 40-65% or approximately 50-+10%. It means that approximately 3 from 6 C-the amplitude of the iceborne-intericeborne alteration- form in the result of greenhouse effect (IPCC, 2007).

However "greenhouse" warming comes forth, in the result of it may thaw some ice covers and water level will increase to 5-7 m only during ten years. It will indeed global catastrophe: many countries (for ex. Netherlands), the biggest cities of the world –New York, Tokyo, St. Petersburg and others- will be under water (IPCC, 2007).

This kind of thinking which lasts from the ancient ice kern extracted from the depth more than 2 km to the future of the environment considerably depending on the conscious activity of the humanity (IPCC, 2007).

We, practically word-for word quoted more tensive points of the report which stated at the website.

1. POSSIBLE CAUSES OF GLOBAL CLIMATE FLUCTUATION

The position of IPCC is well-known. Now lets try to revise the main geological factors which also may influence to the global climate fluctuation.

Lets revise the main geodynamic factors which also may influence to the global climate fluctuation:

1. Drift of the geographical pole of Earth;
2. Drift of the geomagnetic pole of Earth;
3. The change of the angle velocity of rotation of Earth;
4. The increase of the endogen especially volcanic activity of Earth.

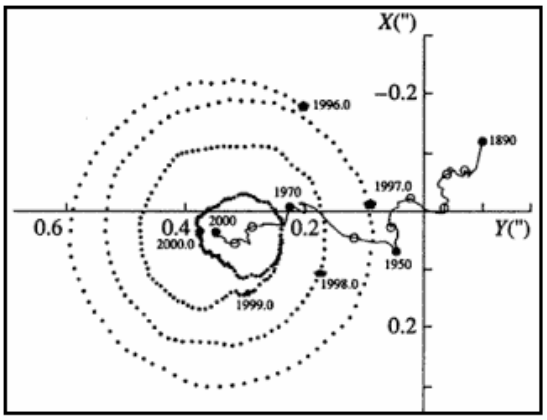

Figure 1. The trajectory of the motion of the north geographical pole 1996-2000 Complete curved line-the trajectory of the middle pole from 1890 to 2000 (according to the information of the international service on Earth rotation, 2000)

In 123 b.c.b Hipparkh discovered the phenomenon of precession of equinoxes. In 1755 J.Bradley discovered other phenomenon –nutation of the rotation axis of the equator. In figure 1. show the trajectory of the motion of the north geographical pole 1996-2000.

The maximal move off instant pole from average stated in 1996. Then the pole began twist in 2000. Attached to the minimal distance to the center of the spiral. From 2000 to 2003 the pole untwisted, but presently again begin to twist, gradually resettling along spiral to its middle position (N.S.Sidorenkov, 2004).

The more move off of the instant pole from the middle does not exceed 15 m. The untwist and twist of the trajectory of the instant pole explained with two periodical motion: free or Chandler with period approximately 14 months and made with annular period.

Chanlder wobble arise when the axial of rotation of Earth deviated from axial of considerable moment of inertia. The compulsory wobble arise with influence of the periodical powers of the atmosphere and hydrosphere to Earth. We will not stop at the principles of Chandler and other types of wobble of axis of Earth. By the way it is obvious that, the difficult fluctuation of the axial of Earth and the result of its geographical pole influence to the global climate processes, namely "oscillation" of axial of Earth arise the seasonal changes of the climate.

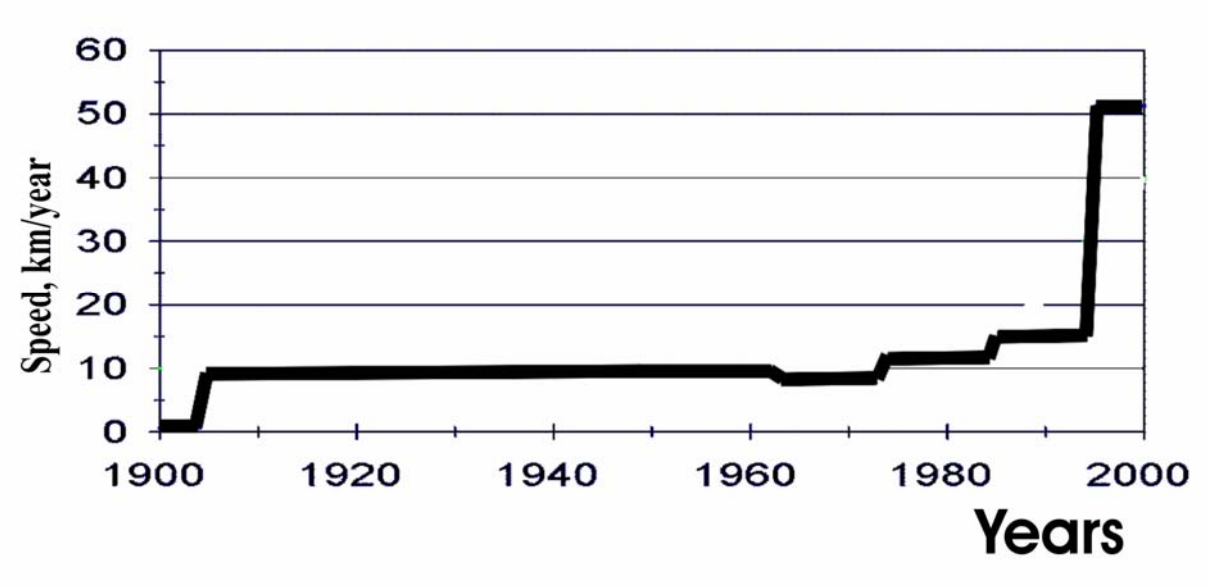

Figure 2. The momentum of the geomagnetic pole (Cocourov.V.D, 2006)

In figure 2 the graphic which characterize the motion of the geomagnetic pole was stated. As we see from the graphic at the end of 90s the velocity of drift of the geomagnetic pole increased five times in comparison with 1980. This fact may testify about considerable alterations in the energetic processes of the core of Earth which forms the geomagnetic pole of our planet. Undoubtedly, this fact may testify about the beginning of the next cycle of the sharp activation of the endogen activity of Earth.

In other hand as it is known the geomagnetic pole forms peculiar magnetic screen which prevents the intervention of the sun radiation, including infected units of the high energy to the surface of Earth. At the same time in the field of the polar caps exist so called

cusps-polar holes. In the result of it the radiation material of sun wind and interplanet space directed to them. The additive agents and energy fall to the polar fields, it become to the "warming' of the polar caps. It is natural that, the alteration of the position of the geomagnetic poles become to displacement of the cusps. It is natural that, this process will result rearrangement of the systems of the cyclones and anticyclones in our planet. It brings to the severe global climate fluctuations.

2. THE VOLCANIC ACTIVITY AND GLOBAL CLIMATE FLUCTUATIONS

Beside it, the cause of the global climate fluctuations is the increase of the greenhouse gas at the atmosphere. At the same time it is obvious that, during eruption of the magmatic volcanoes to the atmosphere of Earth the following gas in big volume emitted: CO_2, CO, SO_2, H_2S, CS_2, OCS, NO.

The concentration of the carbon dioxide fluctuates from 1 to 10% of the common mass of the volcanic gas, 0.1-0.7% CO (Gerlakh.N.M, 1980).

The sulphur content of the volcanic eruption most pernicious influences to the global climate fluctuations. In eruptions of the volcanoes to the atmosphere SO_2, H_2S, CS_2, OCS and pieces of the hard sulphur emitted. In works of Keydl stated that, gas SO_2 consist of approximately 10% from all gas emissions of the volcanoes, it is annular emissions consist of $2*10^7$ (Cadle.R.D, 1975). The analysis of the emissions of the volcanic gas show that, the main sulphur-content gas is SO_2 (2-10 Mt/year). Commonly in the volcanic gas the part of the sulphur gas consist of 1 to 10% (Athaturov.M.L and others 1986).

The big interest shows the analysis of the alteration of the concentration CO_2 at the atmosphere of Earth in the geological past and in comparison this data with the level of the volcanic activity. The results of these researches show at figure No3 (Athaturov.M.L and others 1986).

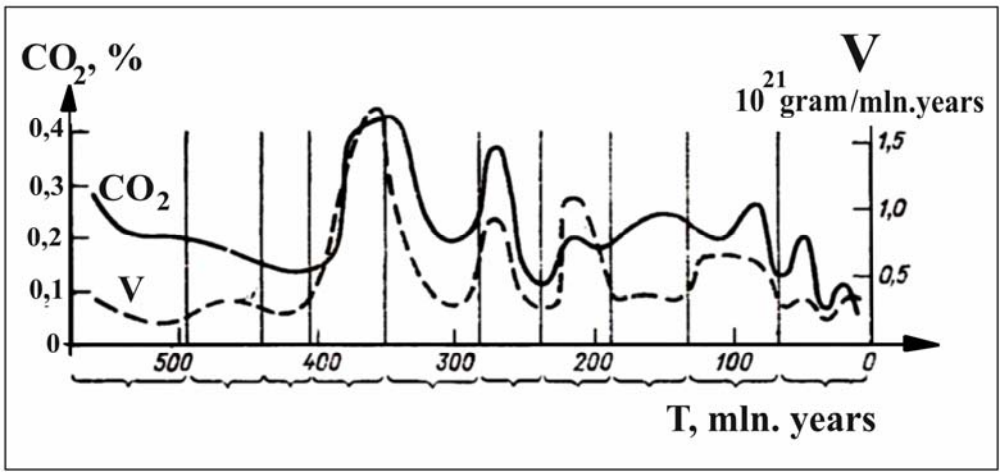

Fig 3. The alteration of the amount of the carbon dioxide at the atmosphere and the speed of the formation of volcanogenic rocks during phanerozoi (Athaturov.M.L and others 1986)

*2007/2008, SWB, Innsbruck, 2008 ISBN 978-9952-451-01-6 **ISSN 2070-0334***

In figure 3, clear that, the concentration of carbon dioxide in phanerozoi changes from 0.1 to 0.4%. The volcanic activity at the scheme characterizes the speed of formation of the volcanic rocks during phanerozoi.

In figure it clear seen that, at the volcanic activity of phanerozoi the cycles with periods 80-100 mil.yer stand out sharply.

The results of the comparison of the schemes show the existence of the direct dependence of the concentration CO_2 from the volcanic activity. To our point of view interesting and important specification of the dependence is the delay of the increase of the concentration of CO_2 regarding with speed of formation of the volcanic rocks. This is completely logical if we will take into consideration the principle of the cause-result relation: firstable the activity of the volcanic eruption increasing then the concentration of CO_2 at the atmosphere and the sequence of these processes has the definite delay in time. Depending on the scale volume of the revising period of the cyclicity the time of the delay will be longer.

Carbon dioxide is transparent for the short wave radiation, but it absorbs long wave radiation of the electromagnetic waves in some diapasons. In the result of it become essential factor which makes the greenhouse effect, increasing the temperature of the bottom layer of the air of the atmosphere of Earth.

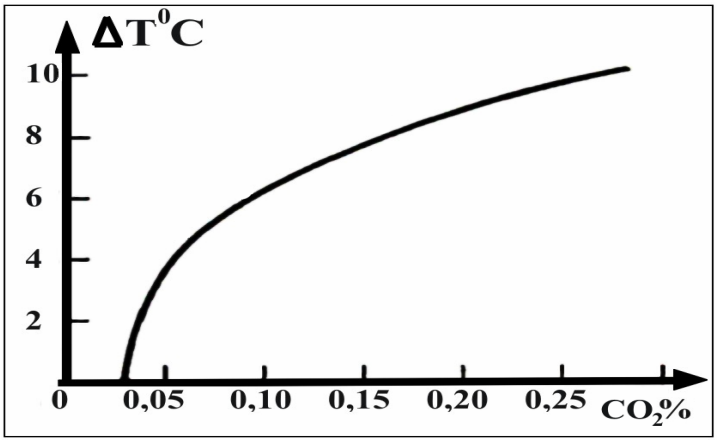

Fig.4. The dependence of the average temperature of the air from the concentration of carbon dioxide gas (Budico M.I, 1979)

In the researches of the relations of concentration CO_2 in the atmosphere and average annular fluctuations of the temperature use the logorhyphmic dependence which stated in fig.4. Budico.M.I researched this dependence on the empiric data at the basis of the research of the geological past. In the works of Budico.M.I stated the presence of the direct relation between volcanic eruptions and global climate fluctuations (Budico.M.I, 1968-1984).

The review of the following works was conducted. It shows the presence of the objective and reliable relations between volcanic activity and global climate fluctuations.

The limitation of the volume of the article does not allow to submit larger review of multiple researches in this field. Whereas from our point of view even the stated works are enough in order to show the correlation of the volcanism with climate of Earth.

3. THE RESEARCHES AND RESULTS

For the clearance of the rate of the possible influence of the cyclicity in the eruption of the volcanoes to the global warming of the climate, the graphics of the average fluctuation of the temperature and average amount of eruption of the magmatic volcanoes of the lines of Earth oblateness from 1850 to 2000 were drew by us, fig. No 5.

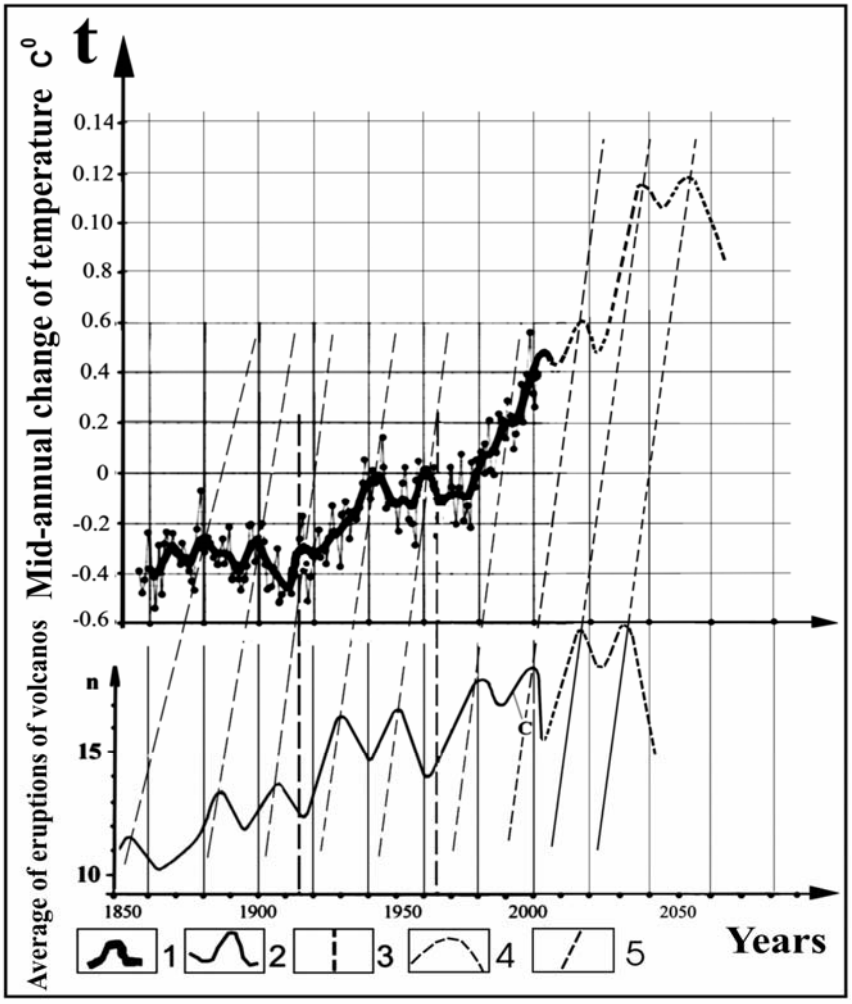

Fig.5. The comparison of the graphics of the average fluctuation of the temperature on Earth and average amount of eruption of the magmatic volcanoes lines of Earth oblateness from 1850 to 2000 (Khain V.E Khalilov.E.N 2004).

1. The fluctuation of the temperature on Earth C (the prognosis part of the graphic, added by Khain V.E Khalilov.E.N, 2008)
2. The graphic of the volcanic activity;
3. Straight, limitive dual cycles of the volcanic activity and fluctuation of the temperature;
4. Prognostic parts of the graphics of the average fluctuation of the temperature and volcanic activity;
5. Straight connectional extremal points of the cycles of the volcanic activity and variation of the annual temperature.

How we stated in the previous chapters approximately 90% of energy and emissions to the atmosphere disengage during the eruption of the magmatic volcanoes type C.

The comparison of the graphics show the high rate of the similarity.

We can distinguish both graphics to three periods: 1853-1915, 1916-1965, 1966-2000. Each period characterizes with sharp increase, temperature and volcanic activity-1915 and 1965. Notably that, in the first period on the both graphics the three cycle of the activation distinguished. At the second period –two cycles, at the third period also two partial cycles.

Most interesting fact is the delaying of the cycles of the increase of the temperature regarding with cycles of the increase of the volcanic activity. On the base of this kind of the delay exist cause-effect relation between two processes. This peculiarity was stated by us during comparison of the graphics of the volcanic activity and concentration of CO_2 at the atmosphere of Earth in run of phanerozoi, fig 3.

Lets revise the mechanism of the cause-effect relation of the volcanic activity and fluctuation of the temperature on Earth. The increase of the amount of the eruption of the volcanoes results to the increase of the volcanic gas emission which make the greenhouse effect. In the result of it the temperature of the atmosphere is increasing. From 1860 to 2000 the amount of the eruption of the volcanoes increased for 80%.

According to the graphics fig.5 the increase of the eruption of the volcanoes annually 5 eruption, correspond to the increase of the temperature in 0.4C. The high similarity of the graphics of the global changes of the temperature fluctuations has the logic basis from the point of view of the physical aspects. The double increase of the eruption of the volcanoes shall become to the double increase gas volume which emitted to the atmosphere, especially CO_2. CO_2 plays active role in the formation of the greenhouse effect and increase of the annular temperature on Earth.

At the base of the defined correlation specifics and usage of cause-effect relation in the various natural processes the effort of the long term prognosis was done. The fluctuation of the volcanic activity of the lines of Earth oblate ness and global fluctuation of the average temperature in our planet to 2060. In the construction of the prognosis part of the graphics the period of the delay of the maximums of the average increase of the temperature of Earth in relation with maximums of the volcanic activity, as well as correlation of the amplitude of the cycles the increase of the average temperature of Earth in relation to cycles of the increase of the volcanic activity.

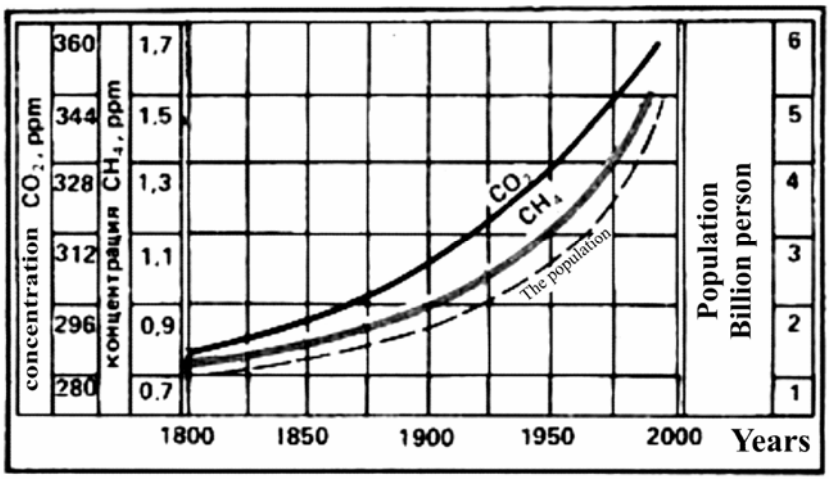

Fig.6 The fluctuation of the content of CO_2 and CH_4 at the atmosphere, as well as the increase of the population on Earth from 1800 to 2000.

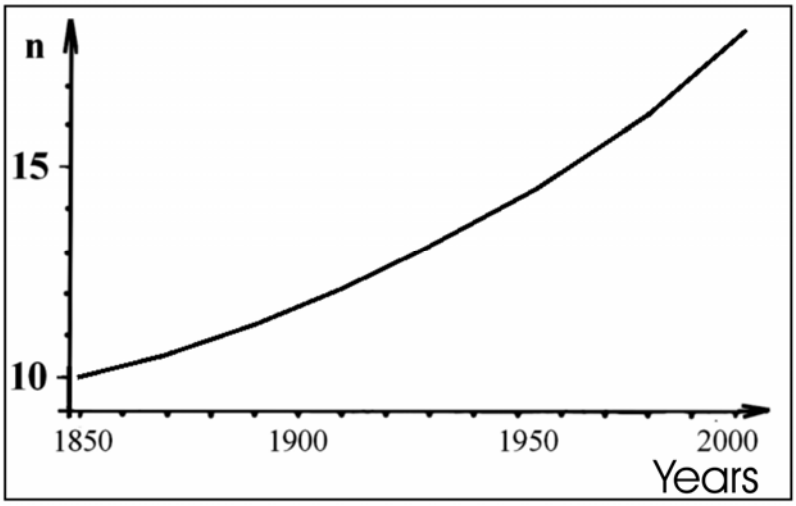

Fig.7. The trend of the volcanic activity

In fig.6 the trends of the alteration of content of CO_2, CH_4 and population upsurge from 1800 to 2000 were shown. In fig 7 the trend of the volcanic activity which express the common character of the increase of the amount of the volcanic eruptions from 1850 to 2000 was stated. The comparison of these graphics show their high similarity.

To our mind the comparison of the increase of the content of CO_2, CH_4 at the atmosphere and the volcanic activity of the Earth may be the direct testimony of the existence of the definite relations between processes.

The researches testify that, endogen processes considerably activated in our planet for the last two centuries, beside it, significant acceleration of these processes observed during three decades. The evidence on it is the character of the alteration of the seismic and volcanic activity, the speed of the motion of the geomagnetic poles, global alterations of the temperature of the atmosphere and content of the endogen gas in it, the alteration of water level of the world ocean and so on.

4. CONCLUSIONS

- The role of the volcanic activity of Earth in the global climate fluctuations is considerably high.
- The main cause of the global fluctuation of the temperature is the increase of the volcanic eruption. It makes the greenhouse effect. So, from 1850 up to day the index of the volcanic activity increase in 80-85%. Consequently the volume of the volcanic gas also increased in 80-85%.
- The global increase of the annular temperature on Earth at the background of the insignificant variations to our mind will be observed till 2050. During this period the annular temperature of the atmosphere will increase up to 0.7-0.8C (fig.5).
- Acceptance the significant role of the volcanic activity in the global warming of Earth will allow to attach to the appreciation of the real results of the global climate fluctuations more objectively. We want to note that, the periods of the increase of the volcanic activity substitute with periods of its declining. To our mind it will begin from 2030-2035.

It will become to the declining of the annular temperature of the atmosphere in 2050.

REFERENCES

1. Athaturov M.E., Budiko M.I., Vinnikov K.Y. and others. Volcanos, stratospheric an aerosol and a climate of the Earth. L: Hydrometeoixdat, 1986, 256 pp.
2. Budiko M.I. The resource of the ice-borne epoch. - Meteorology and Hydrology, 1968, №11, p.3-12.
3. Budiko M.I. The climate fluctuation - L: Hydrometeoizdat. 1974, 280 p.
4. Budiko M.I. The research of the modern fluctuation of the climate. - Meteorology and Hydrology, 1977, №11, p.42-57.
5. Budiko M.I. The problem of carbon dioxide. L: Hydrometeoizdat. 1979, 59.
6. Budiko M.I. The climate in the past and future. - L: Hydrometeoizdat. 1980, 351 p.
7. Budiko M.I. The influence of the volcanic eruption to the climate. Meteorology and Hydrology, 1984, № 3, p. 5-11.
8. Cadle R.D. Volcanic emission of holides and sulfur compounds to the troposphere and stratosphere. - J. Geophys. Res., 1975, vol. 80, N12, p. 1650-1652.
9. Gerlach N.M. Evolution of volcanic gas analysis from Surtsey volcano, Iceland, 1964-1967. J. Volcan. Geotherm. Res., 1980, N 8, p. 191-198.
10. Khain V.Y., Khalilov E.N. Regularity of spatial-temporary distribution of volcano eruptions. International Academy of Science. II&E. Science without borders, Vol. 1, 2003-2004, ICSD/IAS, Innsbruck, pp. 243-251.
11. Sidorenkov N.S. Instability of rotation of the Earth. The bulletin of the Russian Academy of Science, 2004, том.74, №8, с.701-715.
12. http://www.ipcc.ch/

The article is presented on 04.02.2008

SCIENCE WITHOUT BORDERS. Transactions of the International Academy of Science H & E. Vol.3. 2007/2008, SWB, Innsbruck, 2008 ISBN 978-9952-451-01-6 ***ISSN 2070-0334***

RESUME

GLOBAL CLIMATE FLUCTUATION AND CYCLICITY OF THE VOLCANIC ACTIVITY

*Khain.V.E, **Khalilov.E.N
*Moscow State University named after M.V.Lomonosov,
**International Academy of Science H&E (Austria, Innsbruck)

The arguments of the international experts and various scientists on the causes of the global climate fluctuation were analyzed. On the basis of the study of the cyclicity of volcanic eruption of Earth the conclusion on the important role of volcanic activity on the global warming was accepted. The researches show that, the increase of the activity of the magmatic volcanoes results to the elevation of the concentration of the volcanic gas in the atmosphere. In the result of it, the greenhouse effect which brings to the global increase of the temperature of the atmosphere of Earth strengthens.