Aerospace registration of hydrocarbon degassing

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Aerospace registration of hydrocarbon degassing

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Abstract. An active geological study of promising areas for oil and gas is being conducted in areas where geological signs of associated hydrocarbon manifestations are detected. The development of deposits contributes to a developed system of cracks in the surrounding rocks. Fluid supply to fractured reservoirs occurs through the channels of deep faults. Prolonged winter freezing of rocks inhibits the release of gases into the Earth's atmosphere. The accumulation of hydrocarbon gases in the near-surface cavities creates risks of gas emissions, fires and explosions. Prediction and rapid diagnosis of gas emissions is based on planetary observations from satellites of ozone concentration in the atmosphere. V.L. Syvorotkin experimentally showed a causal relationship between hydrogen degassing and the formation of "Ozone Holes". Satellite measurements of ozone concentrations in the atmosphere allow daily monitoring of hydrogen degassing sites from the Earth's surface. The state of the soil surface in the areas of deep degassing is determined by secondary features. These are griffins, soil emissions, ring-shaped structures of gray soil (falling fertility), and hummocks of specific morphology. Such hummocks are formed as a result of the vital activity of "Hydrogen bacteria" and are markers of gas emission on the ground. In combination, methane with hydrogen is capable of detonation at concentrations ranging from 1%. The danger increases in the presence of iron-containing minerals that can catalyze the oxidation reaction. Preventive measures are proposed to prevent the sudden release of flammable gases: by drilling a network of control waste wells with a depth of 100 to 200 meters. Such wells are similar to ventilation wells in areas of coal mining.

1. Introduction

Remote sensing of the Earth is used to assess the prospects of areas for oil and gas. The set of research methods available to the satellite network is expanding. The state of the ozone layer of the atmosphere contains information on degassing in a given field. An additional advantage is the possibility of obtaining information within one day [1].

Over the past few years, fires have become frequent throughout Russia. In the Siberian region, spring-summer fires are repeated almost every year. We link these events with an increase in the level of hydrogen and methane degassing.

The likelihood of fires increases with increasing degassing levels. The second important reason is late thawing of the earth in spring. This negates the damping effect of the hydrogen bacteria present in the soil. Combustible gases accumulate under the permafrost crust during the period of negative temperatures. Permafrost stops the metabolism of soil bacteria. Sharp melting does not give time for the adaptation of bacteria and contributes to the accumulation of gases on the surface. As a result, combinations of gases ready for natural ignition are formed on the surface. Minimization of this impact is an actual scientific problem.

The results of satellite observations must be correlated with the natural structures on the ground. In [2], the registration of the consequences of the activity of hydrogen bacteria is proposed.

The presence of faults and cracks is one of the most important factors that must be considered when assessing the degassing potential of the observed territory.

2. The ozone layer is a hydrogen degassing marker

Первый The importance of data on the state of the Earth's atmosphere is well known. Of particular interest is the ozone layer. Observations on its state are conducted over a number of years using automatic satellites [1]. The state of the Earth's ozone layer depends on the power of the deep hydrogen, methane degassing of the planet [3]. The amplification of these processes is recorded in recent decades. There are various manifestations of hydrogen degassing on the ground, especially in zones of geological faults. Satellite observations of changes in the concentration of ozone in the upper atmosphere make it possible to monitor concentration levels over the entire surface of the planet in everyday mode.

The hydrogen hypothesis of the ozone layer purge is based on firmly established empirical data [3].

The hypothesis was built by V. L. Syvorotkin. The basis laid data on volcanic emissions and other geological structures. Certain geological structures of the earth's interior emit the recovered gases, and it is over these degassing centers that the ozone abundances are most often recorded. There are observations of meteorological phenomena from satellites confined to geological structures (figure 1).

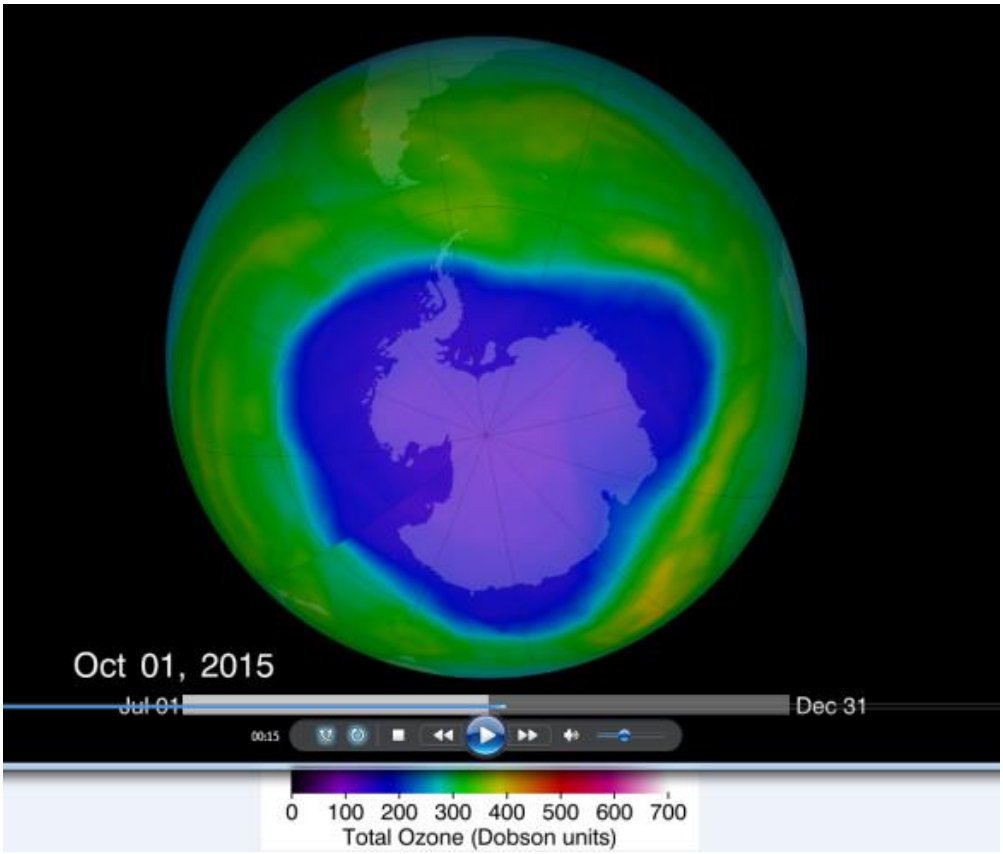

Figure 1. Ozone hole over Antarctica 01.07.15 [1].

In the southern hemisphere, the meridional system of faults converges into a powerful ring fault covering the Antarctic. This Antarctic rift system is the most powerful source of gas, and above all hydrogen depth degassing. These circumstances lead to a drop in ozone concentration above the

Earth's South Pole. Figure 2 shows a schematic diagram of the earth faults. It is interesting to note the areas of oil and gas to the localization of large faults.

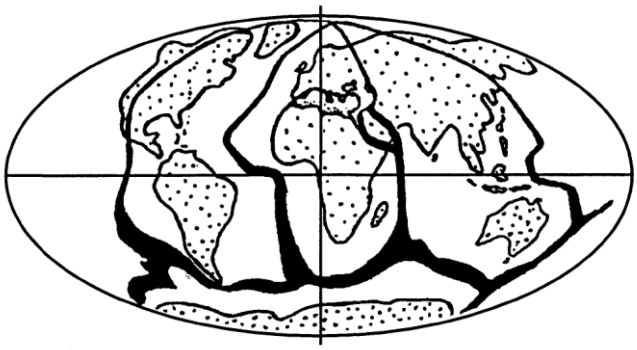

Figure 2. The fault system of the Earth is the basis of hydrogen degassing.

During periods of massive hydrogen degassing, conditions are created for fires on the soil surface. In figure 3 one can see the fall in ozone concentration over the northern part of Russia, in particular over the north of the Krasnoyarsk Territory. The Yenisei River flows from the south to the north of the Krasnoyarsk Territory. The river visually draws the location of a large meridional fault.

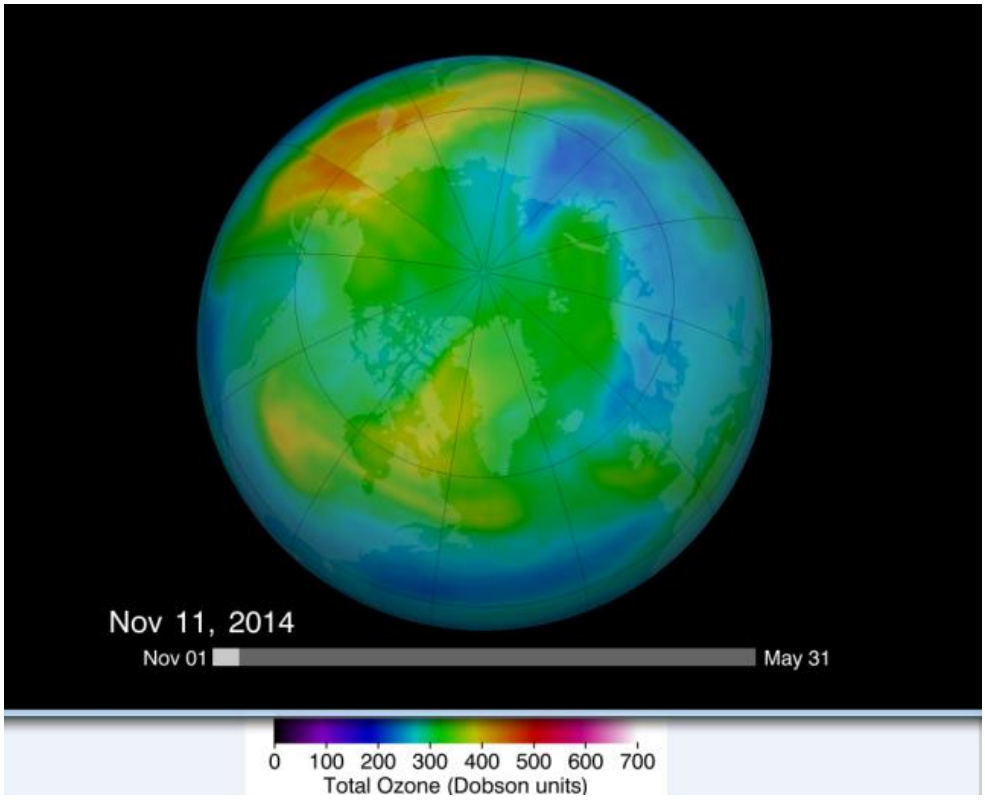

Figure 3. The state of the ozone layer on 11.11.14 according to NASA [1].

November is the time of the autumn revitalization of gas emissions. Observations over the years indicate Yakutia as an area of increased hydrogen evolution. Here is one of the largest meridional faults.

3. Signs of hydrogen degassing on the ground

Hydrogen degassing in the areas of effective output is manifested in the form of "soil cusps", (figure 4 [4]). In the studies of geologist V.N. Larin, it is reported about the multiple manifestations of such

structures on the fields of the Moscow region [4], in areas of hydrogen degassing. A level of hydrogen on the surface of the earth on the concentration of H_2 reaches 1% or more. (стиль 'Bodytext').

Figure 4. Soil bumps from the suburbs. [4].

The appearance of "soil bumps" is obliged to the vital processes of hydrogen-oxidizing bacteria (Hydrogenomonas). Hydrogen bacteria have been studied for several decades as promising producers of biopolymers. Rounded cavities in the bump volume are formed by a colony of bacteria. Figure 5 shows a bump on an island during the Yenisei. "Soil bumps" grow over time with grass and shoots of shrubs. Cavities in the form of bubbles gradually collapse under the influence of precipitation, (figure 6).

Figure 5. Soil bumps swell on an island in the middle of the Yenisei.

Figure 6. Over time, the "bubbles" are swallowed.

The hummocks grow due to the vital activity of hydrogen bacteria. They are found in many places and indicate degassing from the soil surface. Such degassing is linked to the outcrops of deep faults. The meridional faults intersect with the latitudinal faults. Such zones are effective yields of deep hydrogen degassing. In figure 7, the "soil bumps" are photographed along the fault extending from Lake Baikal.

Figure 7. «Soil bumps» go along the break from Baikal.

The intensification of hydrogen degassing studies is associated with the advent of compact instruments for determining the concentration of hydrogen in gases. There is a wide power range of hydrogen exits to the surface of the earth. Therefore, studies of a whole range of issues practically important for the regional economy are promising. These are, above all, safety issues, since hydrogen and methane mixed with air form a detonating gas. Hydrogen emissions in the process of soil melting can contribute to the ignition of dried plants.

Today, leaders have emerged to turn the problem into income [5, 6]. In Mali, natural underground deposits of pure hydrogen gas were found at a depth of 100–200 meters. To the north of Bamako, hydrogen gas was detected with a purity of 98% during the drilling of water wells. This discovery is analyzed using conventional methods to create a working geological model. There is a question about creating a geological model for the occurrence of H2 gas in rocks of Bourakebougou [7,8].

Conducted observations can be considered the basis for monitoring the state of degassing in areas of deep faults and adjacent territories. Markers of deep degassing are griffins, gas emission craters, hummocks with the morphology of the inherent activity of hydrogen bacteria, as well as ring structures of chemical burning out of the soil.

4. Conclusion

When solving the tasks of monitoring observations of infrastructure and natural complexes, the main place is given to deciphering local structures. The correlation of environmental components, territorial (local) objects allows the prediction of emergency situations and accidents. And the use of the proposed technical means allows the elimination of critical factors.

As a preventive action to prevent sudden gas emissions, drilling of ventilation wells with a depth of 100 to 200 meters is proposed. It is necessary to monitor the emission of gases from the planetary and local positions, as well as to install sensors to monitor the emission of gas from the well.

Drilling ventilation wells to eliminate emissions of methane and hydrogen is mandatory in the construction of coal mines [9]. Creating a network of ventilation wells will help prevent fires, provide additional channels for sensing the state of methane and hydrogen degassing. Contingent emissions of methane and hydrogen are difficult to predict. At the same time, the conditions under which they can occur are well known. Detailed risk reduction methods have been developed that should be applied in all cases of detecting signs of hydrogen emissions.

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