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**THE EARTH'S THERMOELECTRICITY AS THE BASIS
FOR POWER SUPPLIES OF MANKIND**

Oil and other fossil fuels are formed of inorganic carbonates and water in the course of their electrochemical reduction by passing electric currents generated due to high temperature of the Earth's interior (thermal currents). Carbon dioxide formed during their combustion, absorbed by the Earth and converted into inorganic carbonates in its depths is the initial raw material of their formation, and due to the cyclic "formation-combustion" process, similar to water circulation in nature, the resource of fossil fuels is never-ending. Within this theory, clear definition is given of such global natural phenomena as non-photosynthetic process of oxygen release by the Earth through the oceans and absorption of carbon dioxide by the Earth through water surfaces.

Key words: thermal currents, electric reduction, fossil fuels.

Introduction

Fossil fuels account for almost all power supplies used by mankind, and without them it is difficult to imagine the today's level of human civilization. Nevertheless, oil ranks central due to its particularly valuable qualities. For some countries it is a vital necessity and to a large extent the basis for national policy. There is no product among the minerals that could be compared to oil in its significance. Annually, a huge amount of energy is consumed in the world which is equivalent in its energy effect to the use of over 11 milliard tons of oil. The share of oil, coal and natural gas is nearly 87 % of all energy resources consumed. And the first place is still occupied by oil which accounts for more than 1/3 of the entire world energy balance [1]. However, despite this, a conceptual scientific basis for a theory establishing the origin of oil in the Earth's crust which would be in good agreement with science, practice and logic does not exist today. Therefore, development of a scientific theory for this branch of science is a relevant scientific task which is also of a big practical value.

To have a chance for existence, any theory in the field of natural science, particularly related to energy and power engineering, should not contradict to the fundamental laws of natural science and logic. Moreover, it should be in full agreement with them. One of such laws is the first principle of thermodynamics, otherwise called "The law of conservation of energy" which means that energy can be neither created nor destroyed – it passes from one kind to another.

We will use this thesis as a foundation on which we will try to construct a theory of formation of oil and all other fossil fuels.

So, oil is energy material or, in other words, it carries energy. If it has energy, then it is only natural to ask: where did it take this energy from or, in terms of thermodynamics, what kind of energy has been converted into the energy of oil? In so doing, this energy, converted into oil, should be more than enough to cover the energy equivalent at least to 11 milliard tons of oil annually.

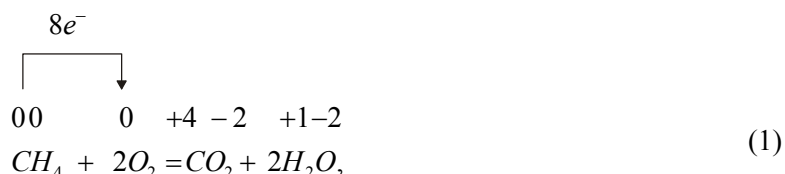
From the above information it logically follows that in the Earth's interior there should be a permanent source of energy whose energy passes into the energy of oil.

It is interesting what kind of a source it might be?

This question will serve a general line of seeking the ways for development of oil formation theory.

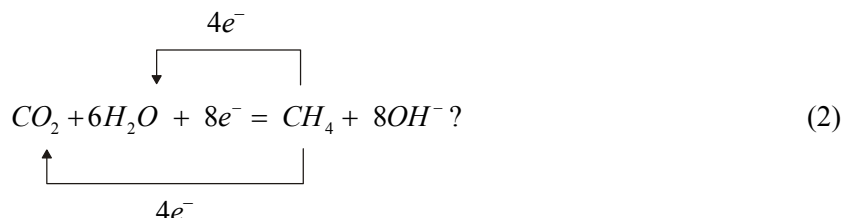
Hydrocarbon formation theory

The problem of creation of a new hydrocarbon formation theory will be formulated as a solution of the inverse problem of complete combustion of hydrocarbons in the presence of oxygen (the reason for this will become clear from the subsequent discussion).



The figures on the element symbols indicate their respective oxidation degrees.

As can be seen from equation (1), its respective reaction is oxidation-reduction, i.e. each methane molecule giving 8 electrons to two oxygen molecules is converted into one molecule of carbon dioxide and two molecules of water. It is natural to ask: could we obtain the initial reaction products (1) – $CH_4 + 2O_2$, if 8 electrons are passed into a mixture of final products ($CO_2 + 2H_2O$)? In other words, could reaction (1) proceed in the opposite direction:

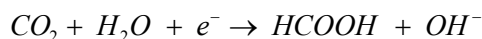


The origin of chemical processes in equation (2) means the reversibility of equation (1). It means the reversibility of processes described by these equations, which is in full agreement with the law of reversibility which is a fundamental law of nature and a principal conclusion from the universal thermodynamics [2, 3] elaborated by a Turkmen scientist, professor M. Mamedov.

Another natural question arises: is there any experimental data – as the basic truth criteria – as regards the electric reduction of carbonate compounds to lower carbon oxidation degrees? Yes, these processes successfully proceed in reactors-electrolyzers [4]. Besides, with carbon oxide reduction, a mixture of hydrocarbons - methane, ethane, ethylene – is formed on a cathode according to reaction:



or, with carbon dioxide reduction, formic acid is formed:



In so doing, processes of reduction of chemical substances are based both on direct and alternating electric current [5].

Thus, the intermediate conclusions:

1. The electrochemical theory of oil formation has sufficiently strong theoretical and experimental basis.
2. On passing electric current through oxidized carbon forms, the latter are reduced to less oxidized forms, sometimes completely to hydrocarbons.

For the electric reduction of carbonate compounds the following conditions should be observed in the electrolyzers: the presence of electrically conducting medium; the presence of electric current; the presence of carbonate material for the electric reduction.

If we show that in the Earth's crust there exist the same or close conditions for the above process, as in the electrolyzers, it will entitle us to admit the idea of the origin of similar processes in the Earth's crust.

According to classical geoelectricity, the electric current in the Earth is generated due to the action of solar plasma flux (the so-called "solar wind") on the magnetosphere [6, 7]. However, in our opinion, the main source of the Earth's electric current is high temperature of the Earth's centre (5000 °C) [8], owing to which a thermal current is formed which is directed from the Earth's centre to its entire surface.

The presence of a permanent magnetic field of the Earth [8] is a direct proof of the existence of direct electric current in it. Since thermal current is a direct current by nature, it should also create a direct field. If a direct magnetic field of the Earth is 99 % of the entire magnetic field of the Earth, it is logical that it is mainly a direct current that acts in the Earth, and since thermal current is a direct current by nature, logically it must be caused by high temperature of the Earth centre.

The presence of carbonate materials in the Earth is beyond question – almost all rocks include, as a rule, limestones, dolomites and other carbonates. In the present work by carbonates are meant all minerals, as well as to one extent or other oxidized carbon compounds.

Thus, we have indicated the presence of all conditions for the electric reduction of carbonates in the Earth's crust – it is electrically conductive, there is an electric current flowing in it and a large amount of carbonate minerals.

It is known [9] that the largest number of oil deposits is located at the boundaries of tectonic plates separated by spaces filled with liquid magma the external manifestations of which are volcanoes, geysers, mud volcanoes, the sources of hot or warm waters. In other words, these are the areas on the Earth's surface where the largest heat flow from the Earth's interior is found. According to the concepts of nonlinear nonequilibrium thermodynamics, if there is at least one flow in some direction, there are all the other possible flows. In this case we are interested in the theoretical possibility of electric current flow from the Earth's centre to its surface. The last achievements of thermodynamic theory, to be more precise, the principle of totality of flows, which is one of conclusions from the linear nonequilibrium thermodynamics developed, as mentioned above, by professor M. Mamedov, also confirms the theoretical possibility of thermal current.

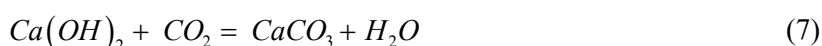
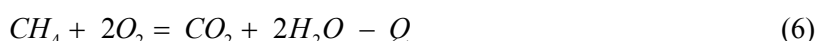
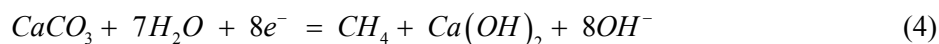
From these considerations the reason for preferable location of oil deposits at the boundaries of geological tectonic plates becomes apparent. Naturally, all other factors being equal, the greater is the flow of heat, hence, of electricity, the greater is the amount of oil and gas.

Thus, the foregoing information suggests the following logical conclusion: oil is formed in the Earth's interior due to passing of the Earth's electric currents through carbonates and water. In other words, under the influence of the Earth's electric currents created by high temperature of the Earth's interior there is a transition of inorganic carbonates to organic, called "fossil fuels".

Basic equations of hydrocarbon formation

For clarity, let us consider full cycle of formation, combustion with generation of energy on the Earth's surface and absorption of combustion products (CO_2) by the Earth for methane which is the simplest hydrocarbon following the way proposed in this theory:

$$-Q \rightarrow 8e^- \quad (3)$$



Let us comment on the schematic and equations (3 – 7).

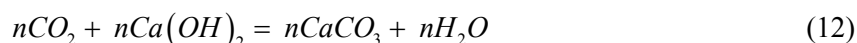
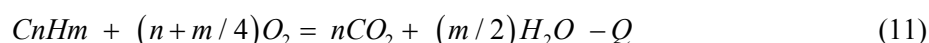
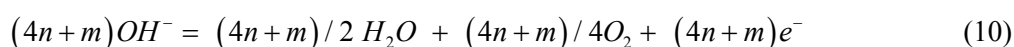
Schematic (3) means that the Earth's heat which actually is a variety of energy denoted by Q , gives in the Earth a flow of electrons $8e^-$, or just an electric current. Later on, this electron flow, having passed through calcium carbonate and water (4), reduces carbonate carbon and hydrogen of water with formation of methane, calcium hydroxide and hydroxyl group.

Hydroxyl groups are passed by "relay-race reactions" through the drainage shell of the Earth and through the oceans they are carried out to the Earth's surface as oxygen and water, preliminarily subject to recombination reaction, and electron in this case also comes back to the initial point in (4). The resulting methane in the form of natural gas is carried out to the Earth's surface and used as energy (6). As this takes place, the initial energy E is released which, in fact, is the Earth's heat converted into thermal current and then methane as the energy of chemical bonds in methane molecule. In so doing, carbon dioxide and water are also formed. Then the resulting water joins total water circulation in nature, and carbon dioxide through the water surfaces and the Earth's drainage shell finally gets to that place in the Earth from where it was retrieved as methane. Naturally, in this case it will be immediately trapped by calcium hydroxide with formation of calcium carbonate. The equations (3), (4), (5) and (7) describe processes occurring in the Earth's interior, and the process described by equation (6) occurs on the Earth's surface.

Thus, our "travel" through equations (3 – 7) has led us to the initial equation (3) on which basis it is quite natural to believe that we deal with a cyclic process.

Equations (3 – 7) yield a precise material balance, which is a further argument in favour of proposed theory. Described by equations (3 – 7), processes for methane as a particular case of the variety of fossil fuel formation processes can be denoted by the following equations (8 – 12) for all fossil fuels:

$$-Q \rightarrow (4n + m)e^- \quad (8)$$



In the above equations (8) – (12) all kinds of fossil fuels are denoted by one formula C_nH_m , not quite clear for non-specialists, hence small comment is needed.

First of all, n and m are only positive integers.

Formula C_nH_m , as a rule, means:

1. $m = 2n + 2$ – aliphatic hydrocarbons – methane homologues;
2. $m = 2n$ – olefinic or cycloaliphatic hydrocarbons;
3. $m = n$ – aromatic hydrocarbons;
4. $m \rightarrow 0$ or $m = 0$ – coal.

Genesis revisited

One of the main problems of Charles Darwin's theory of the origin of species is the absence in nature of the so-called "intermediate biological species", i.e. living organisms between the fish and reptiles, fish and birds, reptiles and birds and so on, which according to evolution theory once existed and resulted in current variety of biological species. Finding in nature of metamorphized remains of similar hypothetical animals would confirm this theory and, possibly, would lead to its recognition. However, they are absent in the nature, at least up to now no paleontological excavation in the world has ever discovered them, casting doubt upon the validity of this theory.

The theory of the origin of species deals with genesis of biological species, and the theory of the origin of fossil fuels offered for consideration of scientists and specialists covers the problems of genesis of oil and other fossil fuels. So, drawing certain analogy between these theories in order to eliminate the disadvantages of the former theory in the latter one seems quite natural.

Thus, putting it in plain language, this theory asserts that oil is formed from any carbonate-comprising rock (stone).

Carbonates are salts of carbonic acid H_2CO_3 ($CaCO_3$ – calcite, limestone, marble; $CaCO_3 \cdot MgCO_3$ – dolomites, etc. are part of many rocks) and comprise acid residual, namely a fragment of CO_3^{2-} which is the object of electric reduction by the Earth's currents, and logic suggests that oil must comprise oxygen-containing compounds. But is it confirmed by facts?

Indeed, oil comprises a variety of oxygen-containing compounds – "these oil components are represented by R-COOH acids, $ArOH$ phenols, ketones, RCOOR ethers and lactones, less frequently by anhydrides and furan compounds, and their total content is 5 – 10 % "[10].

It counts in favour of the idea that a progenitor of oil is oxygen-containing carbon compound, such as carbonates.

The universally known English name for oil is "stone oil". Another English word for oil is petroleum. The geological dictionary says that "petro" means stone, and "oleum" – oil. Again we have come to stone oil! Why did people call this oil stone and not iron, aluminum, wooden or earthen? Why are these two names – stone and oil – inseparable?

One thing is indisputable: if your family name is Ivanov, your ancestor's name was Ivan! And, similarly, if material is called "stone oil", "stone" is of essential, if not major importance in the origin of this "oil".

There is a city called Balkanabat in Turkmenistan previously called "Nebitdag". "Nebit" in Turkmen means "oil", "dag" means "mountain", which is translated into Russian as "Neftegorsk" (Oil Mountain City). But mountain, as a rule, is stones, and again "stone" and "oil" are inseparable. May be, all these are accidents? It should be borne in mind that there are no accidents in nature!

Shales (Fig. 1) belong to terrigenous rocks with a parallel (layered) arrangement of low-temperature minerals. As is evident from the figure below, it is just a stone.

Visual comparison of these two shales shows that combustible shale has plenty of organic carbon which has certainly formed from its inorganic mate. However, are there inorganic carbonates in combustible shales?

Note the following information:

“Combustible shale (Fig. 2) consists of predominant mineral (calcites ($CaCO_3$), dolomite ($CaCO_3 \cdot MgCO_3$), illites, montmorillonite, kaolin, feldspars, quartz, pyrite, etc.) and organic parts (kerogen), the latter making 10 to 30 % of the rock mass and achieving 50 – 70 % only in top quality shales” [11]. As the phrase goes, comment is needless.



Fig. 1. Shale.



Fig. 2. Combustible shale.

We finish the etymology (etymology is a section of linguistics studying the derivation of words) of the word “oil” with the words of a great Russian chemist D.I. Mendeleev: “Of crucial importance are positions of oil areas close to mountain ranges” [12, p. 239].

These perfectly correct notes of the great scientist could be supported and substantiated as follows: almost all rocks comprise carbonates. Mountains, basically, are a product of volcano activity which had abated after a lapse of great time intervals. At the present time the echoes of this abated activity are manifested in mountain regions as the hot sources of water – geysers, mud volcanoes or even active volcanoes. In other words, in the mountains or their vicinity there are oil-forming minerals and heat flow from the Earth’s interior which also account for electric current performing the main oil formation work. However, it does not necessarily mean that oil cannot be found beyond mountains! Fossil fuels shall be there where carbonate minerals are available (and they may be also in the Earth’s interior!), as well as heat flow and, hence, electric current from the Earth’s interior!

Yet another example. It is known that “...Norway is the second largest net exporter of gas in the world and the sixth largest exporter of oil” [13]. But for us the most important is that this Scandinavian country with the world hydrocarbon supplies is near Iceland, otherwise called “The country of geysers and volcanoes”. Naturally, the proximity of places of huge heat flows from the Earth’s interior and the abundance of hydrocarbons is not an accidental geographical phenomenon. Such examples are numerous: the point is that practically all large hydrocarbon deposits are located at the fractures of geological tectonic plates.

Global energy cycle

Processes described above by equations (8 – 12) can be represented in the form of a cyclic process, as shown below. Since this cycle describes formation and use of all conventional fossil fuels

and in view of the fact that they make the basis for practically all (nearly 90 %) power supplies used by mankind, it is reasonable to call it “Global energy cycle” (Fig. 3).

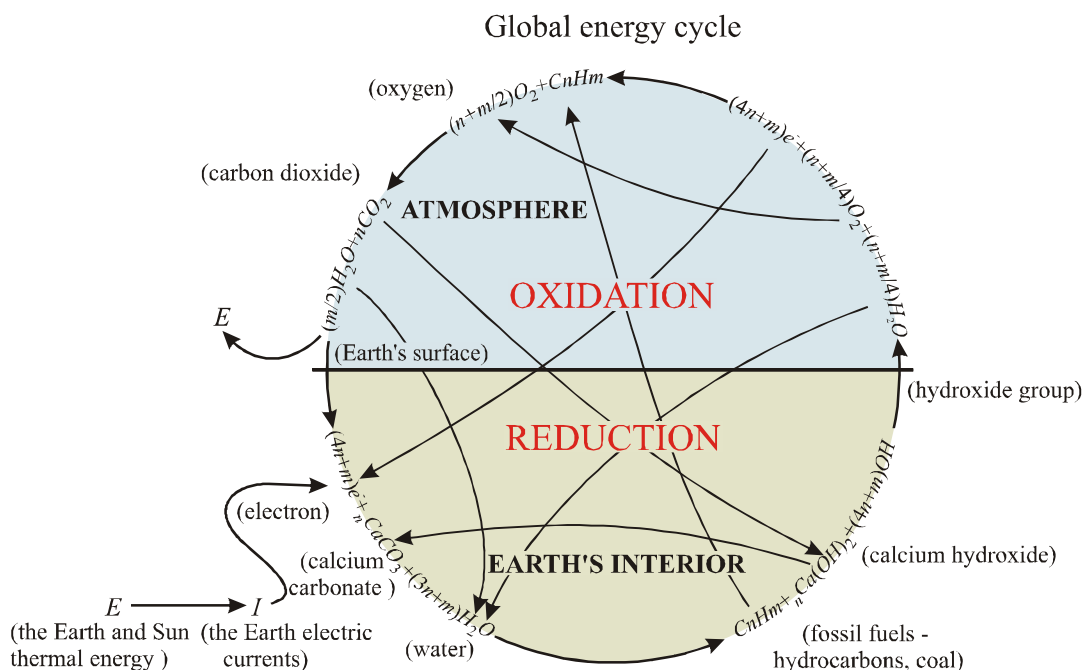
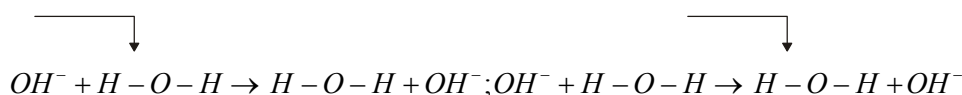


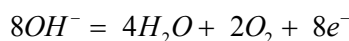
Fig. 3. Global energy cycle.

Letters n and m in the indexes and coefficients have identical values. It is natural to assume that coefficients n and m are functions of parameters characterizing conditions of process origin. It is also logical that coal is also formed according to the above scheme with a large deficit or in the absence of water in electric reduction zone. Thus, oil formation theory that consists in formation of oil and other fossil fuels in the Earth's interior by electric reduction of inorganic carbonates to “organic carbonates” (otherwise called fossil fuels) by terrestrial currents (thermal current) formed by the high temperature of the Earth centre answers all the questions that had been raised in the Introduction. Besides, this theory, on the one hand, predicts oxygen release from the Earth's interior, on the other hand – carbon dioxide absorption by the Earth, both these processes having no relation to photosynthetic process. But is there any oxygen release from the Earth? Yes, this process takes place in nature. Note the following information: “It is known that the main supplier of oxygen to the atmosphere is the world ocean, rather than vegetation” [14, 15]. It is quite reasonable to ask: where it comes to the ocean from?

As can be seen from the above picture and equations, a hydroxyl group which is a charged chemical particle is formed as a product of electric reduction of carbonates. Just like proton H^+ , this particle can be passed along the water chain for huge distances owing to the so-called “relay-race reactions” [16] along the Earth's drainage shell [17, 18] according to the scheme:



and so on, till hydroxyl groups reach the water surface to be discharged with oxygen formation according to known scheme:



and, finally, oxygen comes to atmosphere through the water surfaces.

Is carbon dioxide absorbed by the Earth? Yes, it is. Let's get down to facts.

"Ponds and other small freshwater bodies absorb carbon from atmosphere in much larger quantities than is considered to be the case. John Downing and his colleagues from the University of Iowa demonstrated this by an example of small "farmer ecosystems". They came to conclusion that, first, on the cultivated lands of the USA small ponds absorb 20 – 50 times more carbon atoms than trees planted on the same area. And, second, in the ratio between absorption and area, ponds are well ahead of large lakes.

According to estimates of scientists, there are nearly 300 million natural ponds and lakes in the world, of total area about 4.2 million km², which is twice the figures reported earlier. More than 90 % of these water bodies have areas less than a hectare. According to Downing, ponds and lakes contribute to carbon circulation no less than oceans with all their weeds [19].

Naturally, carbon dioxide dissolved in water also moves to the Earth's interior along the Earth's drainage shell and, finally, gets to that place from where it was retrieved in the form of fossil fuels.

Confinedness of hydrocarbon deposits and earthquakes to the boundaries of geological (also called "tectonic") plates, in conformity with the theses of this oil formation theory, suggests the idea that, possibly, earthquakes occur in the cases when oxygen carryover from the electric reduction zone is complicated or impossible due to formation of oxygen-fuel "explosive mixture".

Summarizing the foregoing, it can be stated that this theory claims to establish theoretically the existence of some earlier unknown natural phenomena, namely the presence of thermal current in the Earth due to high temperature in its centre, formation of fossil fuels by passing of the Earth's currents through carbonates and water. It also explains previously known natural phenomena, such as the entry of the bulk of oxygen to atmosphere through the oceans, absorption of carbon dioxide by the Earth and logically substantiates a new standpoint for earthquakes.

Thus, if the Earth's heat does not decline, and it will not decline, then oil, gas, coal will be everlasting! This is the principle of endlessness of the Earth's energy resources. This is the main conclusion from the theory proposed in this study. In this connection, the concept of "nonrenewable energy sources" to which fossil fuels have been referred to this date, becomes meaningless, since they are shown to be renewed. And, logically, repeated formation of hydrocarbons and coal will take place mainly in the same geographical coordinates where they have been formed before and are still formed today.

Thus, one can state the discovery of earlier unknown natural phenomenon the essence of which is that fossil fuels are formed of inorganic carbonates electrically reduced to "organic" carbonate (coal) or its compounds (oil, gas) by the Earth's currents (thermal current) formed by high temperature of the Earth's centre.

Therefore, the earlier hypothesis [20, 21] and theory [22] of formation of oil and all fossil fuels can be considered completely proved.

Logically, the Earth is a natural converter of its own heat via thermoelectricity to the energy of fossil fuels and simultaneously produces oxygen and passes it through the water surfaces to the Earth atmosphere, being its main supplier.

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