On the Origins of Oil
(from 'The Oil Industry in Pennsylvania and in the Caucasus')
D. Mendeleev, 1877

(Translated by Veselin Kostov, February 2008)

The first question about oil that comes to one's mind is its origin. Where did it come from? How? When? The same questions, addressed to coal, clay, chalk, gypsum and other similar substances found in Earth's crust, while being difficult on their own, were resolved with more certainty. The available explanations for the origins of oil, however, remain unsatisfactory. The current assumption is that oil formed somehow from organisms long dead. This is exclusively based on the fact that oil is almost entirely made up of hydrocarbons with trace amounts of oxygen and nitrogen.

Indeed, such substances form from organic material when compressed (?) and heated in an oxygen-free environment. If this is the whole story, then how do we account for other substances of similar origin, such as coal, lignite and peat, also products of similar transformations but with no heat present in the process (?). It is true that we often find oil close to volcanoes and because of this we assume that the heat from the volcanic activity produced the oil from the fossils in the ground. In any case, the majority of scientists strongly support the biogenic origin of oil theory.[1] It seems to me now that even if we consider all available knowledge and information on oil and on the process of organic decomposition, there is no significant evidence to conclude for the biogenic origin of oil. I will try to prove this before I present my own point of view on the subject.

The first step is to acknowledge that oil did not originate on Earth's surface or at the bottom of the sea. If the first were true, oil would have evaporated and only tar residues would be left behind. If it did originate at the bottom of the ocean, it would rise to the surface and disperse in the atmosphere. Consequently, the only possible place for its origin is deep in Earth. In fact, this means that oil has another property, quite different from all other materials mined from the ground, namely that it tends to stay near its place of birth. On the contrary, if we consider limestone, clay, sand or salt, it's necessary to acknowledge the possibility that they could have been transported over significant distances since the time of their formation. In fact, the rivers, seas, oceans and glaciers are quite capable of transporting large amounts of Earth's elements over large distances. For example, the cobblestones of Moscow's streets could have come from the shore of lake Ladoga, the salt from Velichki, and Volga's gypsum could be from any sea or ocean. For oil, we can't assume anything like that, the moment we bring it to the surface is the first time it sees the sunlight. However, being a liquid and thus quite volatile, it could still have originated at a place different from the one we find it at. XXX [2]Nobody has yet succeeded in finding organic material in oil sand. XXX Most likely we need to look for the place of origin of oil deeper then ever before. The reason is the following.

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[1] I shared the same point of view till recently.
[2] I studied a fresh sample of oil under microscope and didn't find any traces of organic material

Right now, the oil we extract is close to the surface. This is the first striking fact during our acquaintance with oil. Indians in America, Burmans in India and Persians in Caucasus discovered and extracted oil by fences, coverlet (?). They drilled there because they found the oil-saturated sand. The slope of the ground and the subsurface layers were the markers that guided their drills. But no matter whether they looked in oil wells or in the XXX, they always found oil and water together, hand in hand. Oil of course, was always swimming on top. The pressure of the water and the oil vapors forced the lighter oil to rise to the surface. We shouldn't think it happened any differently. [3] From this we can draw the following conclusion: oil found at certain depth had and still has all the reason to rise, so we must look for its place of origin either where we found it or even deeper. In the Caucasus and in Europe oil was discovered in tertiary, i.e. relatively young (modern) geological formations and we can safely assume it originated from organic matter from these or earlier times in layers containing flora and fauna from the respective epoch. In these regions we can accept the biogenic origins of oil keeping in mind that the necessary organic mass could be found below the above-mentioned layers. In the layers themselves, however, materials required for the production of hydrocarbons have not been found.

The situation is quite different in other places, in particular in Canada and the state of Pennsylvania, where oil-rich sands are found in Devonian rocks, and Gunt discovered oil even in Silurian limestone. The Canadian oil is in the deepest, Silurian formations while in Pennsylvania it's in the topmost Devonian layer, right below the coal formations. If we accept the biogenic origin of oil, finding oil in Silurian layers must mean that it came from organic matter from the same strata. However, this is hard to believe because we can't find any material capable of producing oil: there are no coal residuals [4], no fossils that could point to a significant development of organisms. We can't assume the biogenic origin of oil to be true unless we find significant quantities of organic material. It looks like the liquids are present but the solids are gone. This is unreasonable. Coal is denser than oil. The chemical and organic reactions are the same everywhere, and we know that organic material can be created in only such a way that starting from a known composition it always ends up as a combination of both hydrocarbons (not only hydrogen-rich, as oil, but hydrogen-poor hydrocarbons as well) and coal. Therefore, it's implausible to assume that oil is a product of Silurian organisms, such as seaweed for example. Someone can say that coal burned, transformed and dispersed and only the oil-rich product of putrefaction was left. In my opinion this is unacceptable. The more likely scenario would be that oil was transformed, not coal, and everyone can state this with confidence. It is even more impossible to imagine an organism that produced only oil but not coal, than to imagine that coal simply disappeared.

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[3] In other words, oil which originated under normal conditions in layers containing and conducting water always rises to the surface and never sinks down. If, for example, there is a crack in the oil-rich layers, water will use this crack to sink but oil will rise through it because it's lighter.

[4] There are rumors of coal found in Silurian layers in the USA. However, the bulk of all discoveries are oil while coal is just a nuisance. Graphite, presumably produced by organisms through heating, was found in even older layers, but as in the case of coal in very small quantities. In order for the biogenic origin theory to be true, coal and graphite must be found in similar quantities as oil.

For the biogenic theory to be correct, we must then assume that oil originated from organisms that lived before the Silurian epoch and could be found in even deeper layers. This is, however, tough to accept. Even if the radical geologists-neptunists are right, saying that not only all the subsurface layers, but also the major rock formations, not containing organic traces, (for example Laurentian formation, named after the St. Lawrence river) are homogeneous everywhere, like the way gneiss and granite were formed in the presence of water, even then it's hard to identify in layers older than Silurian organisms that could have possibly produced oil. The simple reason is that there is no coal there.

If we are still not eager to abandon the biogenic origin theory, we can give it another try by assuming that there truly was an abundance of oil-producing organisms in a certain era, even between the Laurentian and the Triassic. However, we still have to find a way to get rid of all the produced coal. Geological epochs can help us here, since they all differ from one another in the types and quantities of organisms that lived in them and in the conditions under which the remnants of these organisms could be preserved. Thus, the most likely place to look at for the origin of oil is the layers of the Coal Age, because of the huge amount of coal discovered there. The perfect example is the state of Pennsylvania. On top of the Coal Age layer there is an abundance of coal, and underneath (above?!) it – Devonian layer, full of oil. In between – clay. However, nobody considers the fact that the oil and coal could be the result of the same process. But even if the oil comes from the same seaweed, plants and trees that decayed over the innumerable centuries in the air-free underground environment that produced the coal, it could not have penetrated the clay layer. If this did happen, we would not be able to see the oil (stored underground for millions of years) we find today. Even more, oil would have risen to the surface, evaporated and remain as the soil of Baku, rich in oil residuals. Clay, even wet, is like an impenetrable barrier for the oil. The main reason, however, is that the process of bioorganic decay to liquid oil and solid coal, even under normal temperature condition, is impossible. Nobody has ever seen anything like this. If someone considers this possible, the presence of heat is mandatory. If there was volcanism present, we would see other evidences like metamorphism and rock formation, hydrocarbons would be in gaseous form and would not sink because of the wet clay. In short, the circumstances favorable for the biogenic origin of oil are not present. Even more, the composition of this oil is not the same as the one of the hydrocarbons of the biogenic oil; I'll not go into further details as I think that everything said up to now is enough to conclude that *we can't assume that oil originated from fossils.*

But then, where and how was this substance produced in such large quantities, a substance that we find in places located so far away from each other?

The properties of the Pennsylvania and Caucasus regions, which are more or less well known, make us think that the origin of oil is deeper in the Earth, so deep that finding any organic materials is out of question. Another important characteristic is the proximity of the oil-rich areas to mountain ranges. The Alleghany mountains in Pennsylvania are associated with the oil fields the same way as is the Caucasus to Baku, the Kuban Krai and the associated areas. In both regions, going from the top of the mountains to the foothills, we surely find oil. A similar situation, where oil fields are associated with mountain ranges is observed in other places as well. This is the first indicator towards a possible explanation of the origin of oil. The second is the lines or directions, close to straight lines, which are XXX. These lines, very well known and described by the American oil prospectors, are in the same directions as the mountain ridges. This is why the Americans talk about underground oil rivers, and lakes where these rivers end; this is why Wrigley argues in the introduction to his essay (which I mention a lot in this book) about the accuracy of these straight lines at the location of the oil fields setting his argument on the ground that nature abhors straight lines. Nevertheless, he recognizes the almost straight lines of Earth's surface at the sites of oil drilling in Pennsylvania, where success is greatest.

If we consider everything mentioned above, we can make the following hypothesis. A mountain ridge rises due to the internal forces in Earth; its peak can be associated with the vertical crack that goes from the bottom to the top, the mountain base - with the roughly parallel crack that goes from the top to the bottom XXX.

The second crack is compressed with time, but it must stay deep underneath if Earth's crust was escalated from an almost horizontal position (as geology suggests). This crack of the mountain's base gave routes and paths for oil that was located deep below. Earth's surface could be untouched, but deep down multiple cracks could form. One big crack or many small ones – it is basically the same. Thus, we must search for the origins of oil deep down there. It doesn't matter how it formed – plutonic or non-plutonic origin, through vapors, under pressure or as a consequence of water filling the cracks. If we assume oil did form deep in Earth, we must also agree that it has to be on the surface as well, since it can rise one way or the other to places where Indians, Persian and XXX found and extracted it. Oil that rises from cracks deep underground can also spread in Silurian layers (where Gunt found it), in the sand layers n1, n2, n3, n4 of Pennsylvania, in the sands where the oil drillers of Baku and Caucasus found it, even in the clay layers of different epochs where XXX were found. In some places, when oil reached a certain layer, the bulk of the volatile components evaporated and the remainder was trapped unchanged. These layers (like oil traps and oil during drilling) do not produce volatiles XXX. Such sap-rich layers (asphalt limestone (?) for example) are quite abundant and have properties that vary significantly from one to the other. In other places, the bulk of oil mass didn't rise to the Earth's surface, but after being accumulated in the cracks was further distributed to the XXX sands. These sands produce XXX oil, XXX. Oil trapped more or less densely into this sand continues to transform and small amounts of it leak to the surface by cracks. However, the bulk of it remains there. These places are actually the oil reserves. Obviously, the geological age of the layers where oil is found is irrelevant to the age of the oil, but there is a connection between the oil and the physical characteristics of the surface features on top of it. Therefore, the time when oil formed closely corresponds to the time of formation of the nearby mountain range.

Thus, it's easy to understand the main circumstances under which oil spread around the globe[5], but only under one condition – we must understand what and how can produce oil in the depths of all the possible underground cracks. We can't simply assume its existence in some unreachable depths as a given fact. Even more, the existence of any organic matter or remnants at such depths that could somehow produce oil is simply implausible. But if we can't find an explanation of how oil formed, our story wouldn't have completeness, the mandatory property of any scientific endeavor. Neither can we find satisfaction when the questions we asked provide incomplete answers or to admit our knowledge is limited - we need to ask more and different questions. Only then we can make a choice, when our understanding of the subject improves and the answers we seek become more complete. The goal-oriented hypotheses are very helpful for this purpose. In my humble opinion we need something "different" to replace the theory of the bioorganic origin of oil. Using an inductive approach here is pointless; the way to go must be deduction. This should be obvious. We now know that we must put the place of origin of oil somewhere in the inaccessible depths of Earth. Having this as a starting point of our understanding, we must accept that the material that produced the oil is located in the same place. Now we have to deduce what kind of material this must be. To our help will come data that at first glance look irrelevant to our subject, namely: information about Earth's density, the composition of the Solar atmosphere, the tilt of the equator with respect to the orbital plane, how gases interact with each other, how hydrogen reacts with metals, about processes influenced by the presence of water, how pressure changes with depth, how pressure influences the chemical reactions, etc. In other words, to understand the inner workings of Earth, we must have an understanding of a diverse set of scientific disciplines. I'll not go into further details on this here and will only show the relationship between all the above mentioned data and the problem of the origin of oil, assuming all the facts are already known to the reader.

The age-old debate between the supporters of the Neptunian and Plutonian theories about the origin of Earth is in fact not based on radical difference of opinions. The deposition, sedimentation, and fossil content of the different layers can only be explained through the power of Neptune, the god of the sea. Furthermore, most scientists would never argue over the ownership of lavas and basalts of the god of the underworld (although there are a few eccentric characters with different beliefs). Neptune and Pluto, however, have come into existence only after the land and the seas have been created. Therefore, the argument is simply the following: who was the rightful creator of the primordial substances, such as granites and gneiss? Neptunists claim they were formed under the influence of water while plutonists insist they cooled from the molten crust. Here the former were the winner. It is necessary to acknowledge that when these rocks formed, water was already present on the surface, although we can think of this period as the co-reign of both water and fire – just like the boiling pot, where the two elements compete with and complete each other. However, the authority of the plutonists is somewhere else - at the pinnacle of all knowledge, at the fundamental level of understanding of the world - where the questions are about the origin of Earth, its thermal history and connection to other

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[5] For example, different geological ages of the layer; homogeneity of the layers, different densities at different depths; locations along and close by mountain ridges, near volcanoes; presence of salt water, etc. It is hard to explain everything in this short article. Besides, I only want to explain my main idea.

planets, about the Sun, the Solar System and the stars. Laplace with his 'Exposition du systeme du monde', especially with his last XXX in this book – this is a true Plutonist! He gives a beautiful explanation how Earth and the other planets of the Solar System formed when the extended atmosphere of the young Sun rotated and compressed at the equator (ecliptic) under the influence of gravity. If Helios, God of the Sun is the grandfather of Earth, Pluto is his righteous heir, and what's left for Neptune, his grandson, is the surface of the Earth. The last is now the sole ruler of our planet but this doesn't mean it was always like that. There was a time when Neptune was not yet born and Pluto was king on Earth. To reject this hypothesis, one must not only argue with Laplace's reasoning, but also has to explain why all the planets rotate around their axes and around the Sun in the same direction as the Sun does around its axis and why all planetary orbits are in the plane of the Solar equator (ecliptic) with only minor deviations. The French mathematician intentionally introduced the unity of Nature, this scientific dogma, to the world. Plutonists strictly follow his teachings and in this is their main strength. Let us follow Laplace, as so many other scholars did, and try to find out what will happen to the material that left the solar atmosphere. This material is a mixture of elements with high temperature. Initially, it formed a ring close to the Solar surface, like the one we see today around Saturn. Then it transformed into a cloud of vapors, bigger than Earth. Its temperature was extremely high, it was completely gaseous and fully fragmented. It's often assumed that it was in a state of complete chaos and was cooling down gradually. Only when the conditions were right and the cloud started to contract, it began to redistribute itself in density and chemical reactions spurred into existence. This is, however, not very acceptable. Current developments in the studies of vapors and gases brought significantly better understanding of this field. As a result, we can now give a much better explanation of the behavior of the gaseous elements that we find on Earth during those ancient times. To the extent that this part of my explanation is very important for the further development of our topic and because I need to use certain information that is not widely known, I will provide here a few more details on this subject.

Let's define D and δ as the densities of two vapors or gases with respect to the density of hydrogen. These densities will remain constant or almost constant regardless of the mass, pressure or temperature of the two gases because gases, just like hydrogen, stay in gaseous form or vapor even at very high temperatures. This property is conserved even when Marriott's law is not applied to them directly. This conclusion comes from experiments with highly pressurized gases that exert approximately the same pressure no matter what are the specific gases or vapors, though in some degree this does not reflect Marriott's law.[6]

From this follows that we can reason about the relative (but not absolute) densities of gases and vapors under very high pressures, based on their behavior under normal conditions. When the elements of Earth were all in gaseous form, the pressure they were subjected to was many times higher than what we can study today.
Let's imagine we can vaporize all the water on Earth. Then the atmospheric pressure will of course rise. Let's keep dreaming and say that we can liquefy only a fraction of the

[6] See Mendeleev, " On the pressure of gases"

Earth and vaporize the remaining mass. What would happen? The pressure at the bottom of the atmosphere will be many times greater than the current pressure. The size of the atmosphere will increase enormously as well. How would the constituents be distributed in such an atmosphere? The answer can be found using Dalton's law for mixed gases and vapors [7] and knowing how temperature changes with height. Dalton showed that any gas or vapor mixed with other gases is distributed the same way, as it will be if it is on its own. Therefore, gases at the top of the atmosphere have low density δ, while the ones at the bottom have much higher density D. On the other hand, going from the center of Earth to the surface, density decreases, gases and vapors expand and as a result cool. [8] Thus, the peaks of the highest mountains are covered with permanent snow even near the equator. When vapors and gases cool down, they change phase and become liquid and eventually solid. A good example is the clouds that formed from water vapors in the atmosphere. Water vapors are lighter than air and according to Dalton's law must be the dominant component at the top of the atmosphere. However, this is not the case.

The reason is that vapors can easily condense. It has always been like that, the proof being that there are clouds at the colder boundaries of the atmosphere. Moreover, the dissociation that Henri Saint-Claire Deville teaches us about, works not only for phase changes but also for transitions in chemical state. Cooling leads to chemical reactions. This hasn't happened yet at the core since the temperature there is still high, but was and still is happening all over the surface. When metals reacted with oxygen, they produced metal oxides, which are quite volatile compared to the parent metals. These oxides rained down (?!?) and penetrated to certain depth. What was left on the surface was a substance (with low relative density when vaporized), which produced the first compounds at the same time as the first sources of heat appeared (which were at the same time their own source of heat). (??!) [9] Deeper in the Earth, the material was much denser (when vaporized) and there were no chemical reactions. Based on this, and in agreement with other data, we can conclude that simple (basic), very dense materials (with high density when vaporized), made out of elements with high atomic and partial weights, aggregate at the center of Earth. We can also speculate that the temperatures there are so great that all complex molecules and substances are destroyed and all atoms and particles become indistinct (equal, proportional). According to Avogadro's and Gerard's laws, the density is proportional to the number of particles (which is the same as the number of atoms in this case), so all particles (atoms) with high atomic weight will be at the center of Earth while the ones with low atomic weight will be at the surface. There are a few of the heavy ones at the surface and of the light ones at the center, but the dominant species and the relative weight in each location is determined only by the atomic weight. This is

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[7] This is also known as the Partial Pressure Law. On the consequences of this law, relevant to our subject (the distribution of gases in layered atmosphere), I refer the reader to my essay " On the barometric leveling and its relation to changes in altimeters." 1867, pages 46 – 52

[8] I put together all the available knowledge on the temperature in different stratigraphic layers and tried to provide the underlying theory in the journal of the Russian Chemistry and Physics Society, edition 1876, in Bibliotheque universelle de Geneve and in Comptes rendus. We can also try to apply this to even older times.

[9] To some extent, a proof for this statement is the average density (about 3g/cm^3) of the Moon, which is close to this of Earth's crust. According to Laplace's theory, the Moon originated from Earth the same way Earth did from the Sun, namely not from the deeper, denser rock of Earth, but from its surface layers (Earth's crust truly does have an average density of about 3, while the deeper material is much denser).

consistent with what we find on the surface today, namely that light elements (including Ca=40) dominate. Such elements are: hydrogen, carbon, nitrogen, oxygen, sodium, magnesium, aluminum, silicon, phosphorus, sulfur, chlorine, potassium, calcium with atomic weights between 1 and 40. It doesn't matter if we condense, liquefy or solidify them or even use them in chemical reactions, they never produce material 4 times denser than water. Most of the substances we can make from them have about 2.5 times the water density. The average density of Earth, however, measured time and again by Mc'Kelly, Cavendish, Bailey, Reigh and Korney is more than 5 times higher than the density of water. Therefore, the interior of Earth consists of elements, heavier than the ones at the surface. The straightforward conclusion from observations is that such elements can be found only among the elements with high atomic weights. This is also consistent with our understanding of the nature of the forces acting between the atoms. Therefore, just as was stated at the very beginning, here too we can say that the interior of the Earth consists for the most part of elements with high atomic weight, while what dominates the surface are elements with low atomic weight. Now we can take the next step and ask what are these heavy elements that comprise the bulk of the interior of our planet. Let's work on the answer. First things first: the dominant elements in the interior must be also present in some quantity at the surface because Dalton's law states that elements from the interior can be found on the surface and vice versa (even though it requires that there has to be a differentiation between the constituents of the center and the periphery of a gaseous mass). Because of this, elements from the depths of Earth must be also present in significant quantities in the Solar atmosphere, if Earth is to be a part of this atmosphere. If we count all the elements that fulfill this requirement, we'll be surprised to find only one – iron. Let's imagine a spherical body (not unlike our planet) that has a predominantly iron-rich interior with density of 7 and a surface layer with density of about 3 (like what we find on the surface of Earth). Let's further assume that a fraction of this surface material is mixed into its interior. As a result of all this, the average density of our imaginary body will be between 3 and 7, or in other words close to 5. But this is precisely the average density of Earth. [10] Among the elements present in the Solar atmosphere, iron is quite abundant. If this was not the case, we wouldn't be able to so easily observe its spectral lines. Moreover, in the extreme temperatures of the Sun iron could not only partially melt and but even vaporize. It is clear iron must be present in large quantities throughout the Solar System. Even more, its presence in the Sun is confirmed by Thompson's and Kirchhoff's studies of the Fraunhofer lines in the Solar spectrum. Having in mind everything mentioned above, the presence of large quantities of iron in the Sun is undeniable.

To solve our problem, we must find in what physical state is the iron deep inside our planet. To deduce the answer to this question is an impossible task, since iron can react with so many of Earth's elements and whether it does so depends on the relative mass of the different elements participating in the reaction. For example, there are so many

[10] The density of the Sun at the time of separation of the Earth was indeed very low. During that time, the diameter of the Sun was close to the diameter of Earth's orbit. Since then, the Sun has cooled and compressed, but not with the same rate as the Earth, because its mass is 325,000 times larger. At the beginning, the density of the Earth wasn't that high either. Today, it's close to 5 while the density of the Sun is close to 1.5 times the density of water.

elements present in the furnace – oxygen, carbon, nitrogen, calcium, silicon, etc – when the carbon-rich iron is cast, along with the slag (which is similar to the content of Earth's crust), abundant in silicon, calcium and oxygen. These same elements may not even produce cast iron at all if there is too much oxygen, or if silicon and calcium are not there to capture the oxygen that has to release its iron. Therefore, the main concern here is about the relative abundances of the relevant elements, and these are hard to deduce. Let us assume that certain elements and their derivatives condensed in liquid or solid state from vapors in the core. Their properties, physical and chemical, would depend not only on their own characteristics, but also on the properties of other elements that were released together with them and on the quantities of all the different elements participating in the reactions. Coal, for example, is even less volatile than iron, so it is supposed to be condensed earlier than iron. (footnote: At very high temperatures, barely reachable by our current technology, coal does release vapors, but compared to other substances, it is the least volatile. We must assume that the relative density of its vapors is extremely high (see Journal of The Russian Chemical Society, 1870, page 28) and the particles that comprise this vapor very complex. If, however, coal does react with oxygen, the product is gaseous, not solid. If we study iron, oxygen and coal at very high temperatures, then by tracking the relative amount of oxygen we'll notice that either the whole amount or just a part of it will be used. If there is a shortage of oxygen but an abundance of iron and coal, all the oxygen will predominantly react with the coal and the iron will remain either intact or will react with the remaining coal. Iron can dissolve other substances as well and can even retain mechanical impurities during cooling. Throughout the history of Earth, there has never been much oxygen in its interior [11], because of its low atomic and partial weight (which means that it has low density and does not liquefy under pressure). As a result, we can't assume there is lots of oxygen in the core, even though free oxygen and oxides are quite abundant on the surface. If then we assume that pure or cast iron is covered by slag or oxide, there is no chance for surface oxygen to reach the iron. In other words, *it's possible* to accept that deep in Earth there is, at least partially, oxide-free iron or iron carbonates. Based on this, it will be easy to explain how oil originated in the deep interior.

But before we move on, it is necessarily to remind ourselves one very important thing that helps proving everything mentioned above. To those that will ask why is all this necessary, I'll answer this: the only reasonable way to study subjects like ours is by gathering and using all available information. Meteorites, for example, provide another strong evidence to support our theory. As members of the Solar System, they too, just like Earth, must have originated from the original Solar material. Their remnants, that we so diligently gather, must come from the internal or surface material of some planet. This unknown planet must have gone through the same events as our planet did. If the hypotheses we presented here is correct, the processes in our Solar System must be the same throughout. Among the meteorites we find, there are quite of few made of iron (even though not the majority). There is also a number of carbonated iron (iron carbonates?) ones. Furthermore, the metals we find in meteorites are sometimes mixed with rocks, slag and oxidized substances similar to the material we find in Earth's crust. Most importantly, carbon is mixed with meteoritic iron the same way as in cast iron:

[11] This is the most important statement that helps to solve the essence of the problem

some of it is mechanically mixed (these carbons, together with other substances less soluble than iron, define the vidmanshtet (?) figures that are produced when acid reacts with meteoritic iron), while the remainder is mixed chemically. It has been proven that there is iron in basalts as well, iron which restores the copper from the solution (?). However, it is not very clear whether this iron is with carbonates or free. It is highly unlikely this is the case. There is also lava in these basalts, which comes from the interior of Earth and spreads on the surface. Basalts also capture the iron that is stored deep in Earth and thus confirm the similarity between the meteoritic iron and the one in Earth's core. Often, iron and rocks are mixed in different proportions in meteorites.[12] This is not a hypothesis anymore – it is a fact. Thus, it is not only possible, but also completely acceptable to assume that there is carbonated iron in the interior of our planet, or in general – carbonated metals.

Now we can return to our explanation how oil was produced in the depths of Earth, in the cracks under the mountains. Let's imagine that the hard crust of Earth is relatively thin compared to the total radius, an assumption generally accepted. Beneath this rigid layer there is a soft and viscous material and there is carbonated iron in between. When a crack forms, because of cooling or another reason, leading to the peak of a mountain, the surface above it bends and another crack forms at the base of this mountain, or at least it weakens, loosens up a bit. The crack will cause this weakening because it creeps up. Water can penetrate through these cracks deep into the interior, all the way down to the accumulated carbonated metal.[13] We all know what happens after this: iron or other metals will react with the oxygen from the water and produce oxides, releasing hydrogen. Some of this hydrogen will escape free, but what is left will react with the carbon that was in the carbonated metal, producing hydrocarbons – the volatile substance that is oil.
The liquid water that reached the hot material in the interior will produce vapors. Some of these vapors will escape through the cracks and bring along the hydrocarbon vapors. While rising, the latter will cool down, liquefy and be stored in the appropriate layers.

What type of hydrocarbons will the above-mentioned be? Most probably, the same as these in oil. Indeed, when cast iron reacts with acid, it produces other hydrogen-poor hydrocarbons. However, if we further process these hydrocarbons with heat, expose them to more hydrogen, or put them under high pressure (and as we know, deep down there at the cracks the pressure is immense, there is no question about this), according to Bertelle they will eventually end up as the same hydrocarbons as the ones we find in oil.[14]

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[12] Moore, a famous Neptunist, tries to explain the origin of meteorites by assuming they were made in water solution in the 179th volume of the Annals of Lebech. He considers basalts to be a result of sedimentation as well. Very few people believe in that.

[13] It doesn't even have to be very deep; it's enough for water to reach the mix of carbonated iron and rocks, or anything that resembles basalts.

[14] Dobr (see Comptes rendus, vol. 74-1541, 75-240) found 30 % iron derivatives - 3 % carbonated iron, 40 % free iron and 1.5 % carbon-free iron - in one meteorite; another sample had 3.6% carbonated iron. In the Greenland meteorite Nordenshield (Berichte d. deutsche Chemische Gesellschaft 1871-988), he found 10 % coal and organic materials. The above-mentioned iron, when heated up released enormous amount of gas with resinous smell (Jahresbericht fur Chenin 1871-1240). Another meteoritic sample had 2.3 % carbon. All these facts deserve to be carefully examined. It would be also beneficial to study the effects of water and acid on the crystalline manganese cast iron, in which was quite recently discovered that it's possible to insert up to 9 or even 10 % of carbon (as announced by Chernov, the famous metallurgist from Obuhovsky

Following our argument that that oil cannot possibly have originated from organic material, we must look for an alternative explanation. Considering all the requirements about its source of origin, we can build it upon the above-mentioned information about the possible presence of carbonated metals in the interior of the Earth, the way water penetrates through the cracks and how it reacts with these carbonated metals (that are very similar to cast iron).

What motivated me to establish this hypothesis of the mineral origin of oil were Laplace's origin and evolution of the Solar System theory, the studies of meteorites and the laws governing the behavior of gases and vapors. If I come upon another complete theory about the origin of oil, I'll be equally satisfied. Nevertheless, I believe it is about time to study the problem of the origin of oil.

In summary, let's restate the two theories about the origin of oil. Approaching the problem from the point of view of the neptunists, there is the organic hypothesis, in which oil comes from fossil organisms. The other side of the coin is the mineral hypothesis, which elaborates that oil is the product of water reacting with deeply buried carbonated metals. This is what plutonists believe in. But, both schools are purely theoretical. It is often said that theory and practice do not go well together. This, I believe, is a big mistake. Why this is so is best seen when one deals with geological problems. Production of cheap salt became possible only after a sound theory about the formation of rock salt and the salt sources was available. Only then it became clear enough where to go, where to dig, what solutions to use and how to best extract the rock salt. The same argument holds true for the oil industry.

The most important issue of oil production – how to find it – is not very well understood. We are drilling here and there, following some obscure signs and many of our efforts are often in vain because we don't know with certainty where to drill. It'll be so much easier when we put an end to all this guessing. This is particularly important for our drilling in the Caucasus. Oil was discovered all over the place, but most of it is in Baku and on Kuban. A comprehensive executive decision about where to drill, however, does not exist. Where should those drill just starting this business? If we base our decision on the organic hypothesis, it'll be hard to pinpoint a location. If, however, we believe in the mineral hypothesis, the best places would be along the ridge of the Caucasus. The same goes for the state of Pennsylvania – the ridge of the Allegheny Mountains should be the guide for our drills. How deep should we drill? To answer this, we must first do a few test drillings at sites where oil was found. If we find clay and sandy layers, if the slope of these layers and the oil content in the sand can be estimated, then we can easily find other places to drill. For all these reasons, if oil producers want to become more efficient labor- and investment-wise, they should clearly understand the benefits that come from this theory. Even more, they should support and help refine this mineral origin of oil hypothesis. For this reason, while targeting this essay primarily to the practical issues of oil production, I implemented along certain theoretical knowledge and questions.

Steelworks). The Director of this factory, A.A. Kolokolcev, personally sent me some of this type of cast iron. When reacted upon with acid, this iron produced gases and liquids with the distinct smell of oil.