Various Chemical Properties of Carbon Isotopes in Natural Synthesis of Different Compounds

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Abstract: The previously unknown different chemical properties of carbon isotopes in natural processes of synthesis-formation of different carbon-containing compounds, in particular of the more difficult (13C) carbon isotope in the processes of synthesis of solid carbon-containing compounds: carbonates, diamonds and, respectively, lighter (12C) synthetic isotopes, including methane have been established.

Key words: Isotopes, different chemical properties, high-voltage electromagnetic field, calcite, diamond, hydrocarbons, vein carbonates.

The rapid incarnation of a magmatic fluid with specific P-T parameters in the formed region of the fracture is accompanied by a powerful compression of the components of the fluid itself and the substances present there, which leads to a jump in temperature and pressure growth, but not by supplying additional external energy, but from internal energy itself. This process is called an adiabatic process. Abnormally elevated temperature and pressure cause the fracture-formation of surrounding rocks and minerals, which, in the course of their healing in the form of inclusions—“micro deposits”, conserve the synthesized range of hydrocarbons of a particular phase state. The generation of cracks occurs most intensively and with a minimum of energy along the verge of the interaction of individual atoms or molecules with microdefects in bodies: dislocations, submicrocracks and vacancies. Displacements, for example, depending on their size, and given by the lattice parameters of crystals, can contain in their volume chains of both atoms, radicals and molecules. When externally exposed to the body, particularly, by heating or mechanical stretching of the crystal, the process of moving dislocations with the mentioned particles in some local areas of the body sees individual atoms form molecules, and water molecules fall into the correct orientation inherent in crystal ice with enhanced parameters of the crystal with increased parameters. The case will create a powerful local mechanical stress.

In parallel with the synthesis of molecules from single atoms and the formation of a “lattice” of ice from water molecules, there is a significant release of thermal energy, which further weakens the energy of the bond between the atomic planes of the crystal with the shielding, which leads to their rupture, namely the formation of cracks. To confirm, we say that the synthesis of a hydrogen molecule from its individual atoms is carried out with the release of thermal energy equal to 4.1 eV/atom.

In nature, cracks have a width of (0.01…1.0) × 10^-3 m, and the length exceeds this value by a factor of more than 10^6. Cracks with such parameters are not only good conductors of fluids in the bowels, but also testify (after their healing) about migration phenomena, which are the basis for developing the search criteria for the hydrocarbons themselves. High-voltage electromagnetic field and high temperature cause any hydrocarbon-containing substances to disintegrate into...
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separate atoms, radicals, ionized particles, which, after stabilizing the physicochemical situation in the region under consideration, interact with each other to form a complex mixture of hydrocarbons. These hydrocarbons formed are mainly smaller such as—CO₂, N₂, H₂S. The second important role of the electromagnetic field is that it creates two regions in the reaction volume: regenerative and oxidizing. Particles ·C, H⁺, C₅H₆⁻ radicals in the reductive region chemically interact with each other by a previously proposed mechanism [1, 2] synthesizing a complex hydrocarbon mixture of a kind of oil or bitumen together with gases. In the second, the oxidation region of oxygen and its hydroxide oxidize the weakly oxidized fluid part, for example FeO to Fe₂O₃ or Fe₃O₄; C, CO to CO₂. It is also important here to state the presence in the reaction volume of high molecular weight C₅H₆⁻ radicals formed from poorly decomposed organic matter contributing to the synthesis of higher molecular weight hydrocarbons. Hydrocarbons synthesized under these conditions can form deposits or they manifest in the defects of many minerals: calcite, quartz, barite, “marmarosh diamonds”, etc., and carbonate, quartz-carbonate rocks, which are formed in parallel with minerals. High-temperature fluid tightly fills and cements the cavities of macro- and micro-cracks hundreds of meters-kilometers in length and microns-millimeters-centimeters across [2] with an oriented radius centered in the area of the deposit. Methane containing the smallest diameter among other hydrocarbons and the least pronounced sorption properties will be incarnated into the surrounding rocks of the area under consideration most intensively and over considerable distances. For example, consider that vein carbonate from wells 1-Sushenitska (Carpathian oil and gas province, interval 4,577-4,587 m) contains (volume %): total hydrocarbons (CH₄, C₂H₆, C₃H₈) 52.60; CO₂ 44.93; N₂ 2.16; H₂ 0.31. These results strongly suggest the presence of hydrocarbon deposits near the specified interval. The carbonate substance of the vein was part of the mineral component of the deep high-temperature fluid, and the hydrocarbons and other compounds present in the defects of the vein minerals are generally products of the above-mentioned high-temperature processes.

By mass spectrometric method, it was found that gas inclusions in the “Marmara diamonds” from the vicinity of the village of Vyazma are significant. Fury (Duklyanskaya area, upper Cretaceous) contains (volume %): CH₄ 97.48 and N₂ 2.52; similar inclusions—village Volovets accordingly: CH₄ 97.66 and N₂ 2.34, and from the area with Lower Gate (Krosna Zone, Oligocene) in type inclusions L₁ + L₂ + G contains: CH₄ 62.21, C₂H₆ 6.71, C₃H₈ 6.06, C₄H₁₀ 3.97, C₅H₁₂ 1.32, CO₂ 1.04, N₂ 5.37, H₂O 13.32.

Therefore, the main gas component of inclusions in “Marmara diamonds” from different places of the Carpathians is methane with a dominant content, and the age of the rocks with these quartz carbonate veins is little influenced by the hydrocarbon composition. It is important to genetically relate Marmara diamond crystals to tectonic faults as evidence of mineral synthesis during the migration of hydrocarbon-containing and mineral-forming fluids and changes in multicomponent fluid over time, especially intensely at the time of water enrichment.

Because the metamorphic rocks of the Rakhiv massif on the sedimentary strata were carried out in the Late Cretaceous, the migration of hydrocarbon-containing fluids in the Carpathians, which occurred in the interval between the Late and Middle Pliocene, was caused by active tectonic conditions [3].

Therefore, the nature of the distribution and the total composition of the gas components of fluid inclusions in vein-impregnated minerals is one of the most important indicators of fixation of fluid-bearing fracture zones, the manifestation of deep fluid flows, the genesis and formation of oil and gas, the simultaneity of their migration by fault zones in large territories of oil and gas regions, including Ukraine, and gives reason to anticipate their accumulation in
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trap structures from the formed yum deposits of oil and gas [4].

In the Department of Geochemistry of Deep Fluids at the Institute of Geospatial Sciences of the NAS of Ukraine, I conducted a unique experimental study: the composition of volatile compounds in a separate inclusion was studied—the growth zone of two parts of a diamond octahedron. We developed the mass spectrometric method developed by grinding the sample in high vacuum at room temperature. In a specially designed vacuum mortar, the diamond was successfully split into two parts—one in the growth zone, which was immediately recorded in the system leaving the device by the deterioration of the vacuum due to the isolation of volatile compounds from this defect, because the growth area itself was a sealed defect on the side of the crystal. The second, it confirmed, as a genetically primary inclusion, the primacy of the nature of the preserved fluid, which formed the crystal itself. The main volatile substances isolated from the growth zone of this octahedron from the Ayhal tube were carbon dioxide and nitrogen in lower concentration.

Accordingly this created [5] a new mechanism for the formation of natural pyropic and diamond crystals under the influence of magma in some parts of the lithosphere where deep faults in which the melts in the direction of the crust take root. During their migration in the contact zone of the melt rock of the lithosphere, as a result of their contact interaction, a high-voltage electric field of complex form arises, in which CO₂ transforms into an excited state; its molecules break up into separate radicals and atoms with subsequent ionization. In the fault tube, these radicals, ions, atoms fall into the zone with the available iron compounds, and in such a melt environment, they interconnect, synthesizing diamond crystals with simultaneous formation of pyrope, magnetite, quartz, and the like. During the formation of diamond crystals, carbon isotopes are differentiated with their weight. By migrating the fault tube to the earth’s surface, high-temperature fluid in its path contacts with various rocks, which under the influence of high temperatures decompose into separate components, in particular carbonates—to carbon dioxide and oxides. In such complex physicochemical conditions, deep CO₂ is supplemented and mixed with the isotopically light CO₂ composition of these carbonates, which together become a source of carbon source for further growth of diamond crystals from already total CO₂ with a lightened isotope composition. The most optically pure diamonds in the melt are synthesized by carbon atoms with \( \delta^{13}C = -6.1\% \) at the entrance to the fault tube. At the beginning of the synthesis process, the composition of the melt does not change or change minimally by slowly migrating the fault tube towards the crust. Under these conditions, the growth of crystals is carried out by carbon atoms, whose isotopic composition is slowly changing, in particular crystals are enriched by the heavy isotope and can acquire significant positive values. Such diamonds are called heavy and belong to ultra-basic kimberlite paragenesis. During migration by a fracture tube in the lithosphere, the melt with diamond crystals enters the area with carbonate rocks with a lightened isotope composition, which, under the influence of a deep high-temperature melt, decompose with the release of CO₂, which is mixed with a deep residual CO₂.

At this stage of the synthesis of diamond crystals, the differentiation of the carbon isotope composition goes backwards from positive values to significant negative ones. In parallel, the change of the initial mineral-forming melt-medium leads to a change in the color of the upper newly synthesized layers of crystals with the capture of additional impurities-inclusions. This kind of diamonds is called lightweight and is referred to as eclogite paragenesis. With respect to the third variety, it will be formed in cases of reincarnation of an additional portion of deep carbon dioxide from the asthenosphere and is an exceptional phenomenon. The information provided forms the basis of the scientific discovery.
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Discovery Formula

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Reference

[1] Svoren, J. M. 1984. “Admixtures of Gases in Crystals of Mineral Sand Other Solid Bodies (Their Extraction Methods, Composition, Location form Sand Effect on the Properties of Substances): Candidate of Disciplines Lviv.” 19.

[2] Svoren, J. M. 1992. “Nutrition of the Theory of the Genesis of Natural Carbohydrate Sand Hatches for Fun. Tectogenesis and Naftogasiferousnadr of Ukraine.” 143-5.

[3] Svoren, J. M., and Naumko, I. M. 2007. “Thermobarometry and Gas Geography of Veinlet-Disseminated Mineralization in the Reports of Oil-Gas-Bearing Regions and Metal-Containing Provinces: Glybin Fluxes.” Additional. NAS of Ukraine 9: 91-5.

[4] Svoren, J. M., and Naumko, I. M. 2006. “A New Theory of Synthesis and the Genesis of Natural Carbohydrates: Abiogenic Biogenic Dualism.” Add. NAS of Ukraine 2: 111-6.

[5] Svoren, J. M. 2004. “A New Mechanism for the Assimilation of Natural Crystals to Diamond and Diamond.” In Mineralogy: History, Theory and Practice. 62-3.