



Fossil fuels? The biogenic theory scientifically at an end – Part 1

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The first part deals with the prevailing theory and its flaws – the origin of petroleum and natural gas from biological fossils. This has been challenged as false for decades, because the formation occurs deep within the Earth and is entirely abiogenic – we will discuss this in Part 2.

Imagine you're sitting in a packed lecture hall. The professor of petroleum geology draws a picture on the blackboard: 150 million years ago, dead plankton sank to the seabed, was buried by sediment, transformed into kerogen under pressure and heat, and finally cracked into petroleum. "Fossil fuel," he says. "At last." The students take notes. No one asks any questions.

There are indeed some. Many, in fact. And they are so fundamental that they shake the foundations of conventional wisdom. This two-part article explains why the biogenic theory—the idea that oil and natural gas originated from dead organisms and plants—is scientifically untenable. And why the abiogenic theory, according to which hydrocarbons are of primordial origin and are continuously formed in the Earth's mantle, is now the **experimentally better supported, field-geologically validated, and thermodynamically consistent** explanation. It is supported by a number of recent studies published in *Nature*, including research conducted in the Italian Alps. But first, let's look at Part 1.

Part 1: The biogenic theory — what it claims and where it fails

The standard model

The biogenic theory states: Dead marine plankton and algae sink into oxygen-free sediment basins, are transformed into kerogen over millions of years by pressure and temperature, and are cracked into liquid hydrocarbons in the “oil window” (60–120 °C).

The main arguments of biogenics:

- **Biomarkers** : Petroleum contains molecules such as porphyrins, sterans, and hopanoids — structurally similar to chlorophyll and sterols from living organisms.
- **Isotopic signatures** : The $\delta^{13}\text{C}$ values of many petroleum products are in the range of organic materials (–20‰ to –32‰)
- **Deposit correlation** : Most known oil fields are located in sedimentary basins with proven source rocks.
- **Optical activity** : Some petroleum products exhibit optical rotation, which could indicate biological chirality.

That sounds convincing at first. But only until you look more closely.

Problem 1: The thermodynamic death blow

The fundamental weakness of the biogenic theory lies in thermodynamics.

The work by **Kenney et al. (2002, PNAS)** — published in one of the world's most prestigious scientific journals — carried out a rigorous thermodynamic analysis of the hydrogen-carbon system. (References in the appendix) The result is devastating:

n-Alkanes—the main components of petroleum—are thermodynamically unstable at the pressures and temperatures of the upper crust. Their spontaneous formation from organic material is effectively forbidden under crustal conditions by the second law of thermodynamics.

only become thermodynamically stable at pressures above approximately **30 kbar** — which corresponds to depths of around **100 km** . **This is far below the pressure of any biosphere.**
n-alkanes

Put another way: **The biogenic theory violates the second law of thermodynamics.** You can't simply pressurize dead algae and make oil from them—physics forbids it.

Problem 2: The circularity of biomarkers

The alleged biomarkers — the crown jewel of biogenic argumentation — are based on a fundamental circular argument:

1. " . Certain molecules are defined as "biological
2. They **are found** in petroleum
3. This **suggests** a biological origin.

This systematically ignores:

- **Fischer-Tropsch syntheses produce branched and cyclic hydrocarbons** —even without biology. The supposed "uniqueness" of biological molecules does not exist.
- **Contamination by microorganisms** in the reservoir is practically unavoidable over millions of years. Oil is biologically colonized—naturally, traces of microbes will be found.
- **Optical activity** is extremely weak or undetectable in most petroleum products — and can be explained by chiral mineral columns during migration.
- **The “unchanging” biomarkers are changing dramatically** : Even the standard biogenic experimental method—hydrous pyrolysis—produces results that, upon closer examination, undermine rather than support the biogenic theory. The “biomarkers” on which the entire textbook edifice rests are thermally unstable and unusable as evidence of origin. What is considered proof of biogenic origin is, in reality, an artifact of shared thermal history. **Bushnev, DA, Burdel'naya, NS et al. (2026)**

Problem 3: 496 oil fields that shouldn't exist

Worldwide, there are **496 documented oil and gas fields in Precambrian crystalline bedrock** in 29 countries. This is rock that:

- **Never** contained organic material
- **It has no** sedimentary parent rocks above it.
- **It shows no** lateral migration pathways from neighboring sedimentary basins

The Dnieper-Donets Basin in Ukraine is a prime example. Soviet and later Ukrainian scientists applied the abiogenic theory as an exploration guideline there—and achieved a **success rate of 57%** . Over **50 oil and gas fields** were discovered in the crystalline basement rock, in an area considered hopeless according to biogenic criteria.

The biogenic theory cannot explain these fields. The abiogenic theory predicts them.

Problem 4: Reservoirs that refill themselves

Several oil fields exhibit the phenomenon of **replenishment** : depleted reservoirs refill over geological timescales with oil that is chemically identical to the original but has different isotopic signatures.

The Eugene Island field in the Gulf of Mexico is a prominent example. A dead kerogen parent rock cannot "replenish" itself—a deep mantle spring can.

Problem 5: The question of quantity

The sheer amount of hydrocarbons in the Earth's crust exceeds all biogenic limits:

- The **giant gas deposits** in the Deep Basin ($12.5 \times 10^{12} \text{ m}^3$), San Juan Basin and Milk River are located in extremely fine-grained, practically impermeable claystones — rocks that are classically considered source or caprocks, not reservoirs.
- The **Jøtul hydrothermal vent** on the Arctic Knipovich Ridge (discovered in 2024, published in 2025) emits **49.7–66.3 mM of methane** —the highest concentrations

ever measured at a mid-ocean ridge. This surpasses even the legendary Guaymas Basin.

- alone **Abiotic methane production in subduction zones** is estimated at **10.8 million tons per year** (Zhang et al., 2023).

Where could all this gas from organic material have come from — and how could it have gotten into impermeable rocks?

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The political component

In any case, the term "fossil" fuels is also used politically by contrasting "fossil" with the claim of "renewable" energy, thus framing old versus new. However, energy is not renewable, according to thermodynamics and the conservation laws of physics.