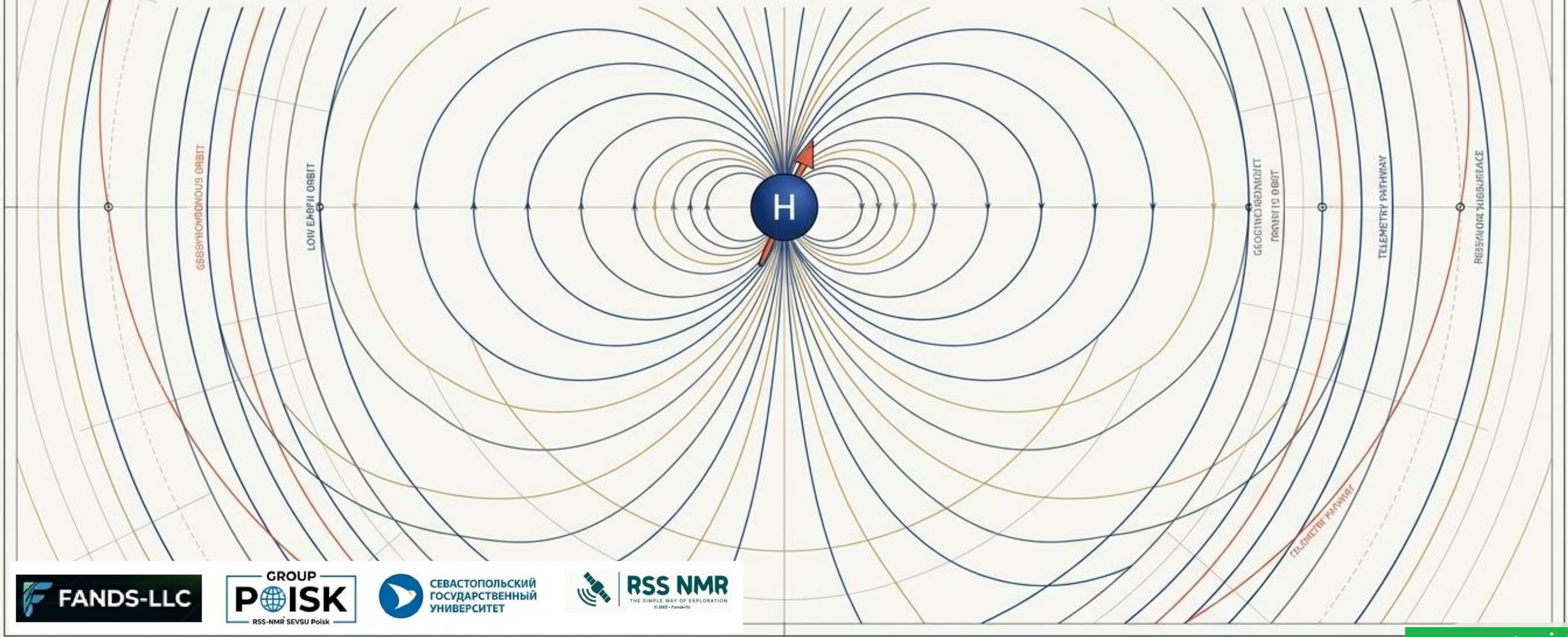
# Resonance & Reservoirs: From Spin to Satellite

## Applied NMR Physics for Orbital Telemetry and Reservoir Permeability




FANDS-LLC

GROUP POISK
RSS-NMR SEVSU Poisk

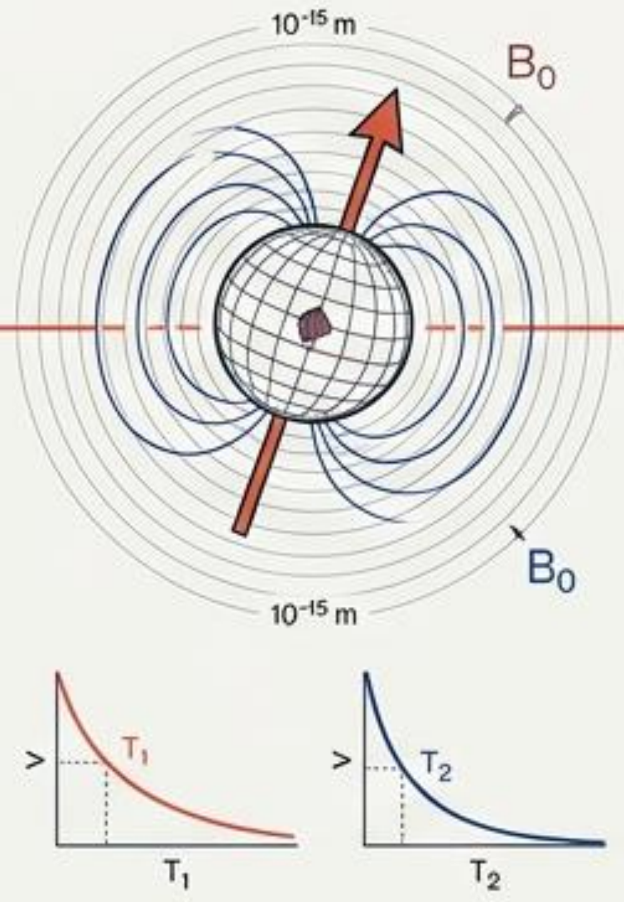
СЕВАСТОПОЛЬСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ

RSS NMR
THE SIMPLE WAY OF EXPLORATION

# The Scales of Exploration

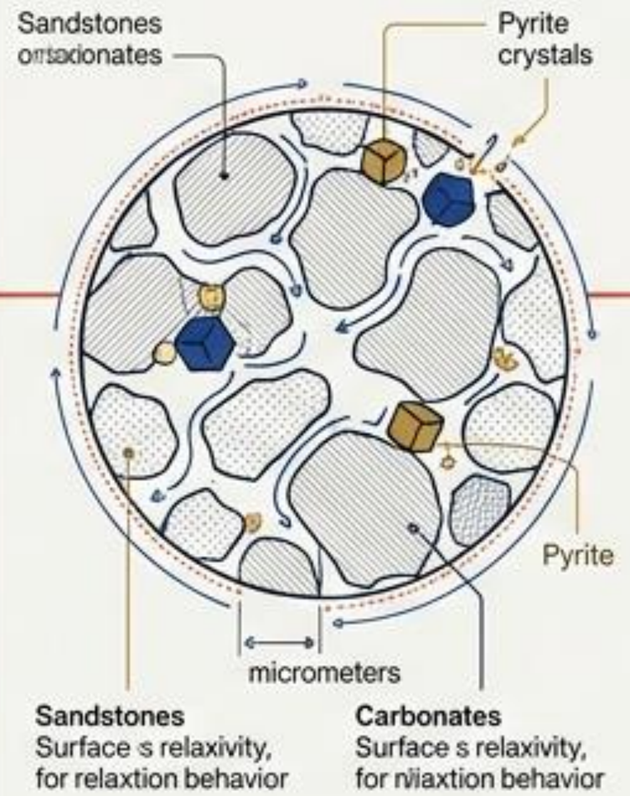
## Atomic Scale (The Proton)

Hydrogen relaxation dynamics (T1/T2) under magnetic fields.



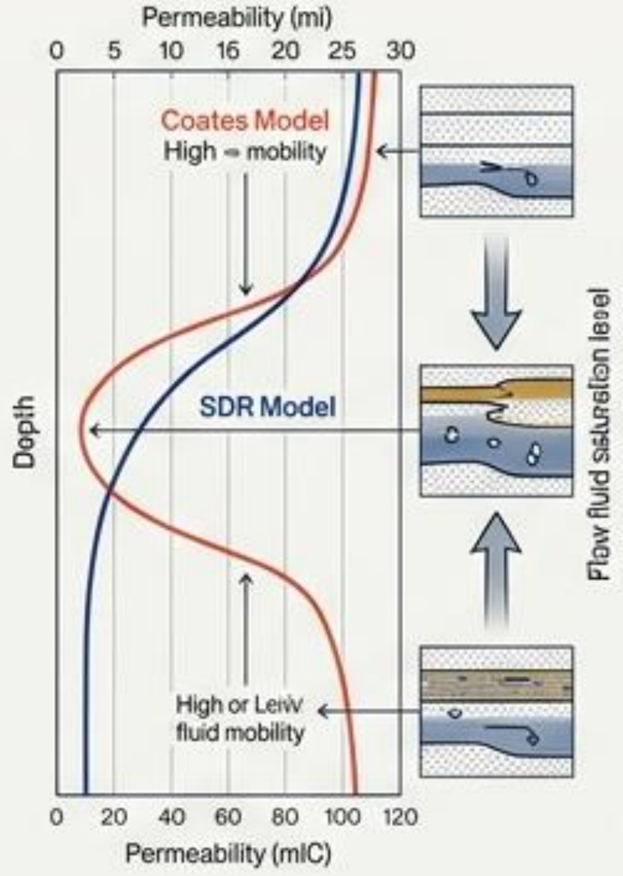

## Granular Scale (Rock Matrix)

Surface relaxivity, pore dynamics, and the pyrite anomaly in sandstones vs. carbonates.



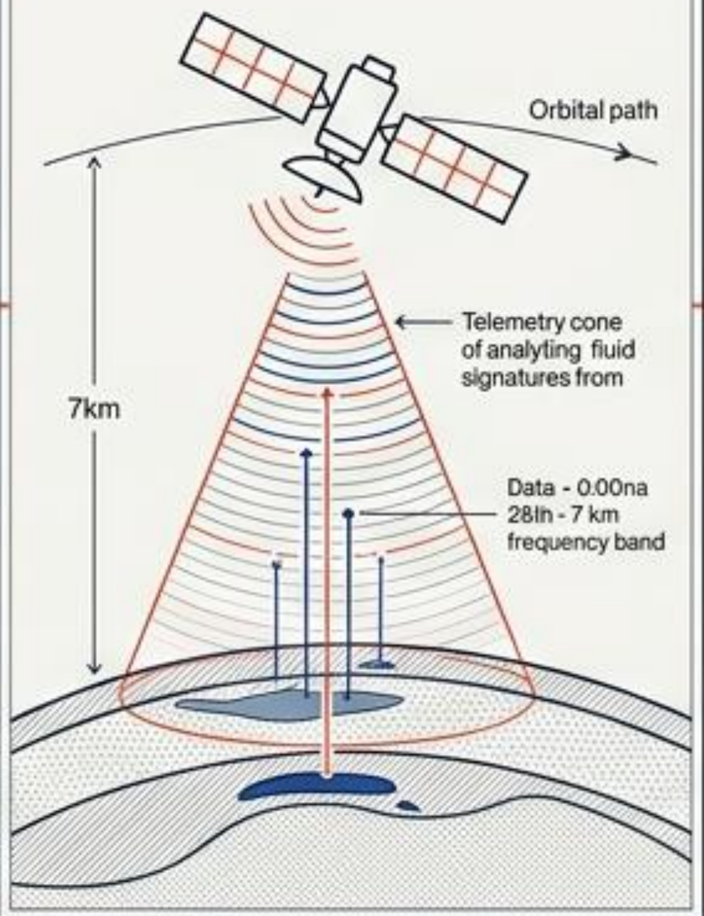

## Reservoir Scale (Permeability)

Diagnostic models (Coates vs. SDR) to quantify fluid mobility.



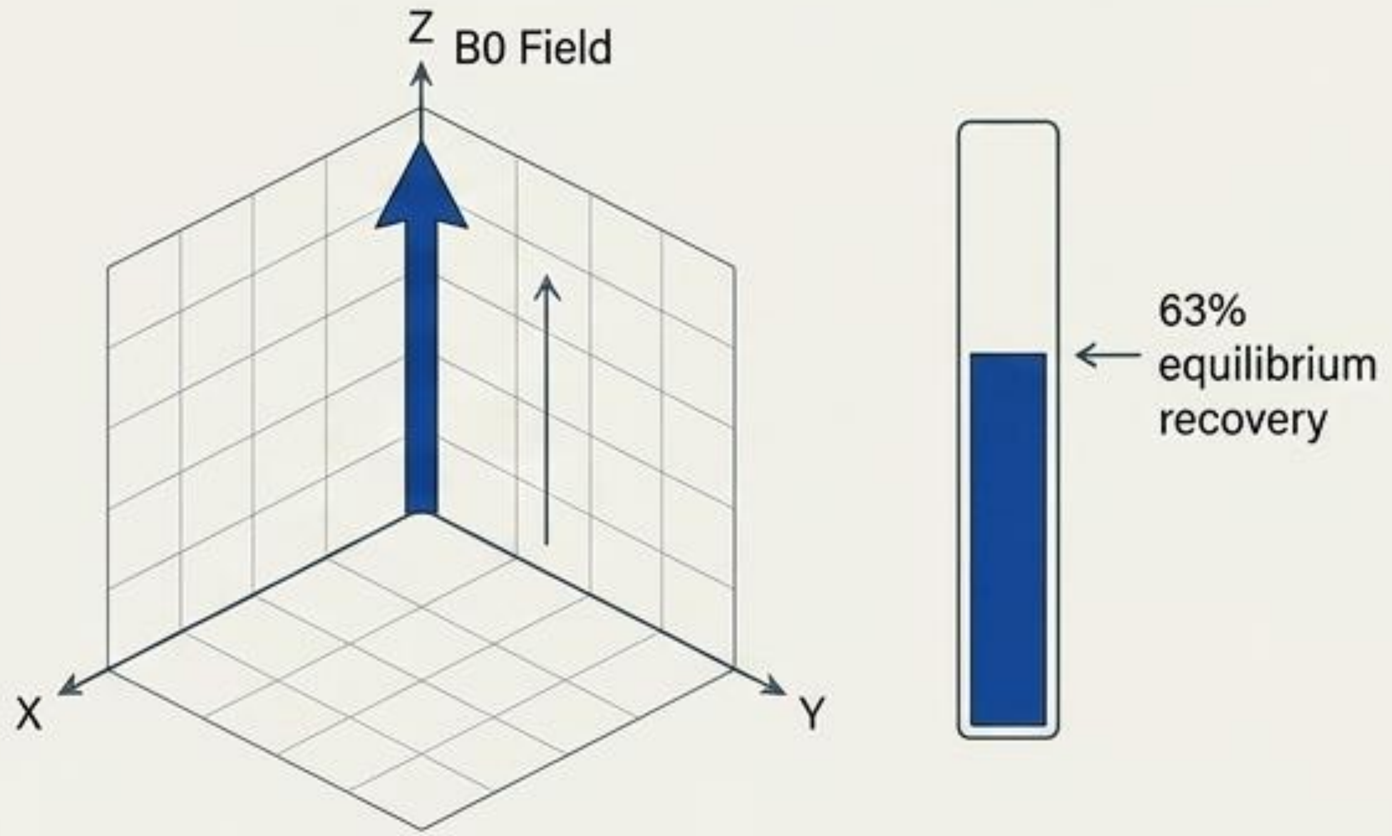

## Planetary Scale (Orbital Survey)

RSS-NMR telemetry detecting fluid signatures from 7km above the surface.



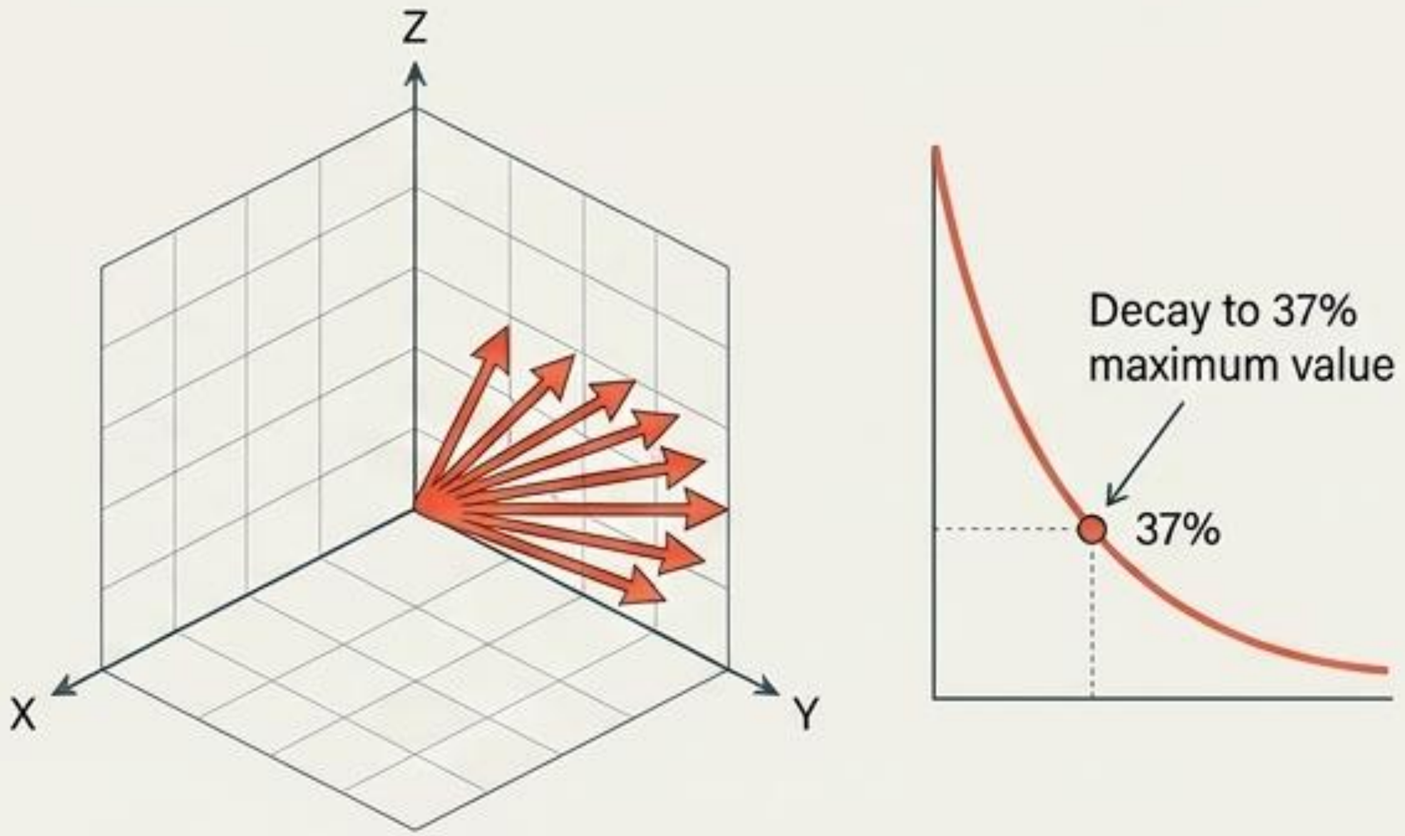
# The Physics of Hydrogen Relaxation

## T1 - Longitudinal Relaxation




Mechanism: Energy transfer to the molecular lattice (Anatomical contrast, highly dependent on tissue/fluid type).

## T2 - Transversal Relaxation

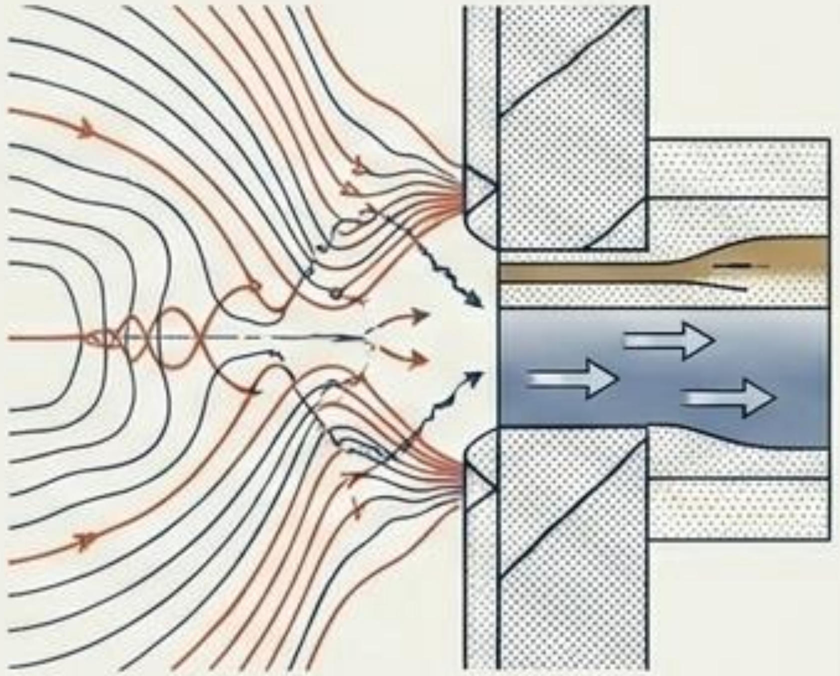



Mechanism: Spin-spin interactions and loss of phase coherence (Fluid contrast).

Rule of Physics: T2 is always substantially shorter than T1.

# The T2 vs. T2* Reality: Effective Relaxation

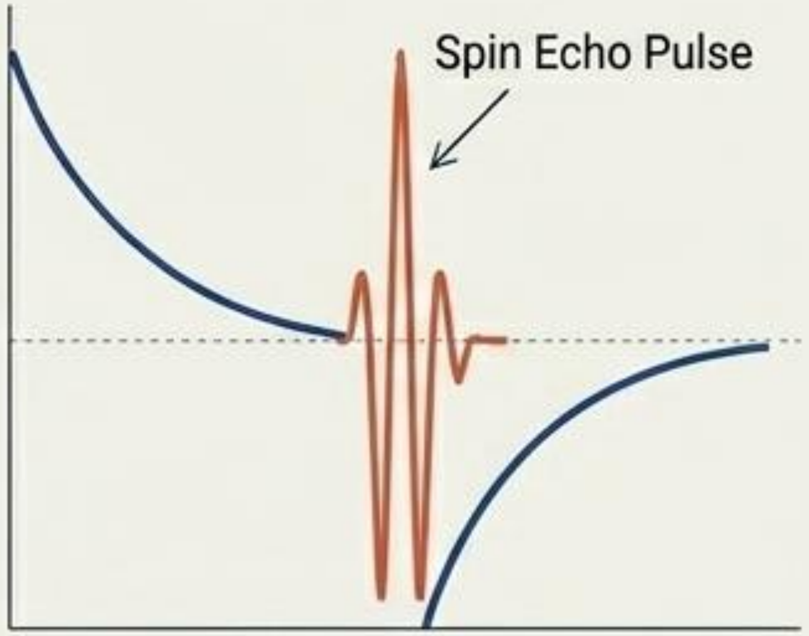
## The Problem



Intrinsic field inhomogeneities (B0) and magnetic susceptibility variances accelerate proton dephasing beyond standard T2 limits.

$$\frac{1}{T_2^*} = \frac{1}{T_2} + \frac{1}{T_{2,\text{inhomogeneous}}}$$

## The Solution




Because inhomogeneity is static, it is reversible. Applied recentering pulses (Spin Echo sequences) cancel this artifact to capture true T2.

# Dynamic T2 Cut-Offs: The Matrix Comparison

$$\frac{1}{T_2} \approx \rho_2 \cdot \left(\frac{S}{V}\right)$$

## Sandstone

**Cut-off Threshold:**
**~33 ms (Short)**

**Surface Relaxivity ($\rho 2$):**
**High**

**Mineralogy Context:**
Contains clay minerals, iron oxides, and heavy metals with paramagnetic properties that accelerate proton relaxation on contact.

## Carbonates

**Cut-off Threshold:**
**~92 ms (Long)**

**Surface Relaxivity ($\rho 2$):**
**2x to 3x Lower**

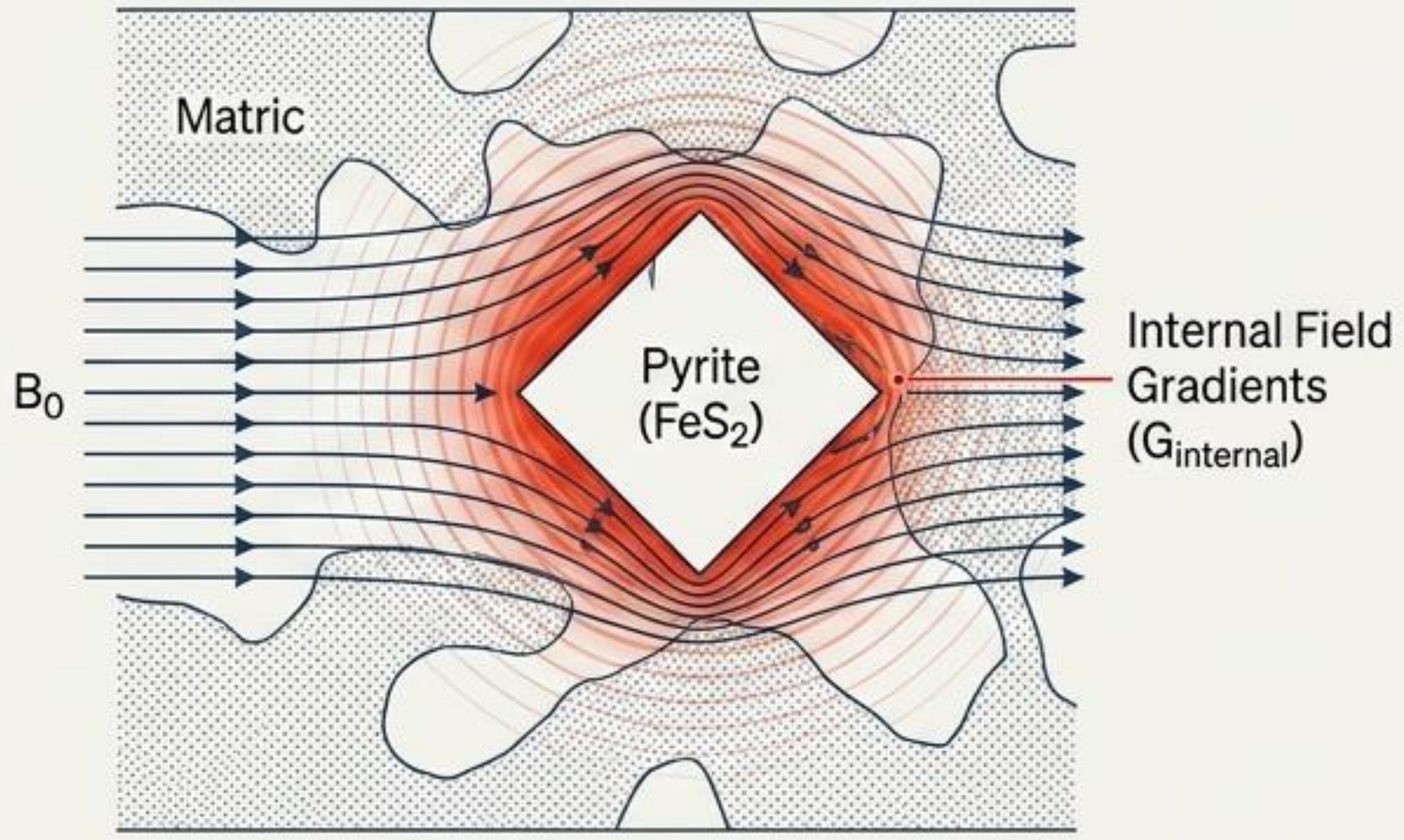
**Mineralogy Context:**
Pure matrices (calcite, dolomite) lacking paramagnetic centers, mechanically slowing transversal relaxation and shifting the cut-off boundary.

Diagnostic Note: The cut-off threshold hydrodynamically separates bound, non-producible water (microporosity) from free, mobile water (macroporosity).

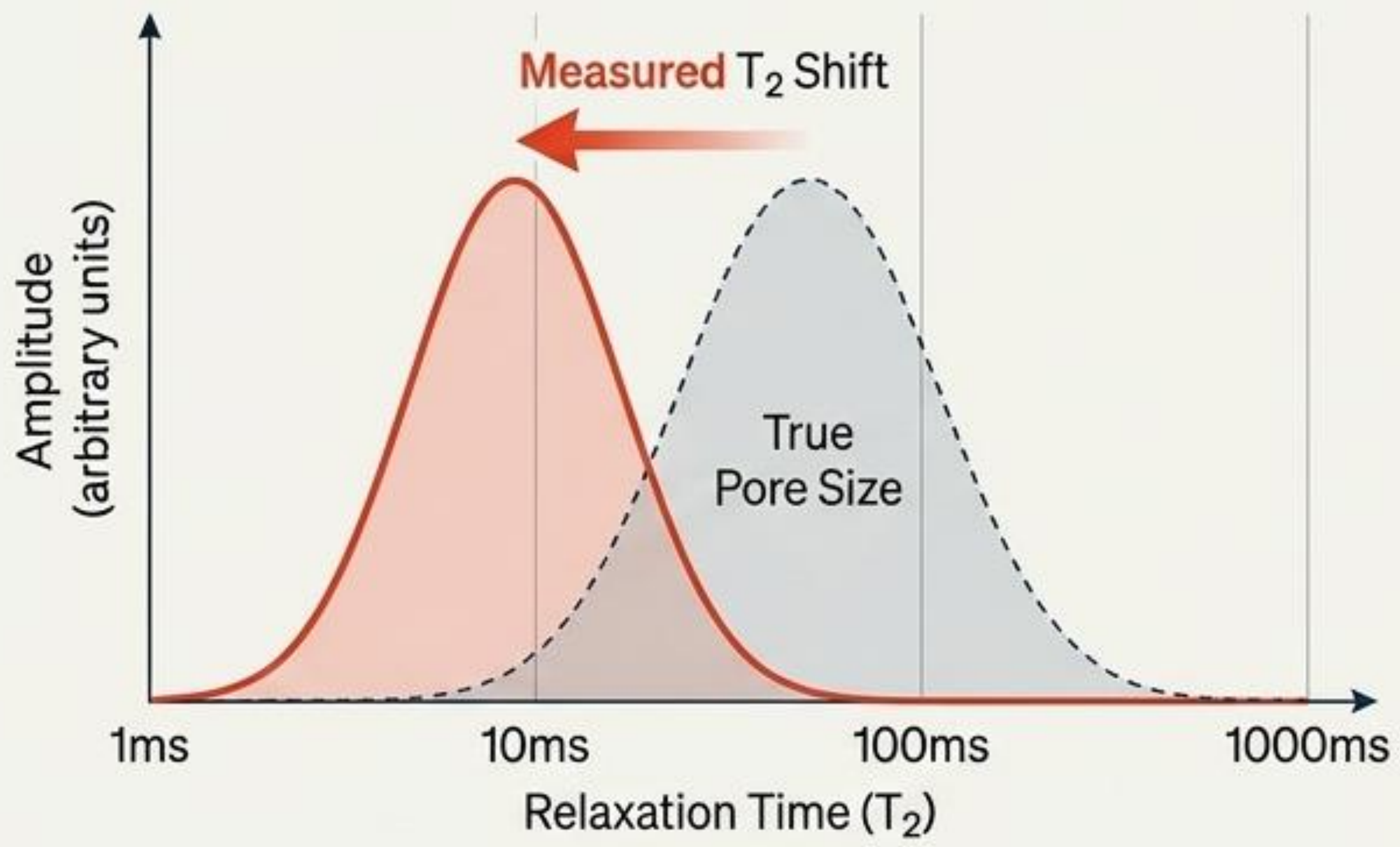
# The Pyrite Anomaly: Magnetic Susceptibility Distortion

$$\frac{1}{T2_{,measured}} = \frac{1}{T2_{,surface}} + \frac{1}{T2_{,volume}} + \frac{\gamma^2 \cdot G^2_{internal}{}^2 \cdot TE^2 \cdot D}{12}$$

## The Cause




## The Effect




**Pore Shrinkage Illusion:** Misclassifies highly mobile, large pores as micropores.

**BVI Inflation:** Drastically overestimates bound water volume (BVI) at the expense of mobile hydrocarbons.

**Signal Erasure:** If dephasing outpaces the minimal Echo Time (TE), the signal is entirely masked.

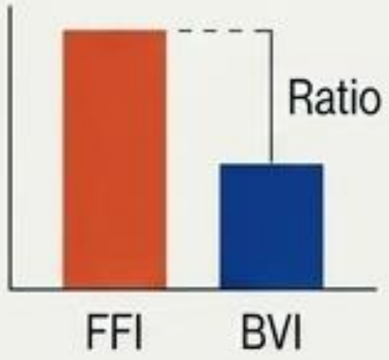
# Quantifying Permeability: Diagnostic Models

## Coates Model (Free Fluid)

$$K_{\text{Coates}} = \left(\frac{\phi}{C}\right)^4 \cdot \left(\frac{\text{FFI}}{\text{BVI}}\right)^2$$

**Mechanism:**
Driven by the ratio of mobile fluids (FFI) to bound fluids (BVI).

**Optimal Use:**
Ideal for sandstones and simple, well-connected pore structures.

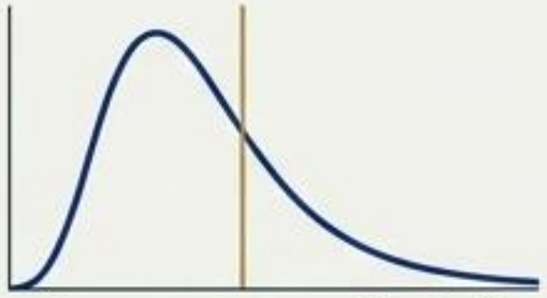



## SDR Model (Schlumberger Doll Research)

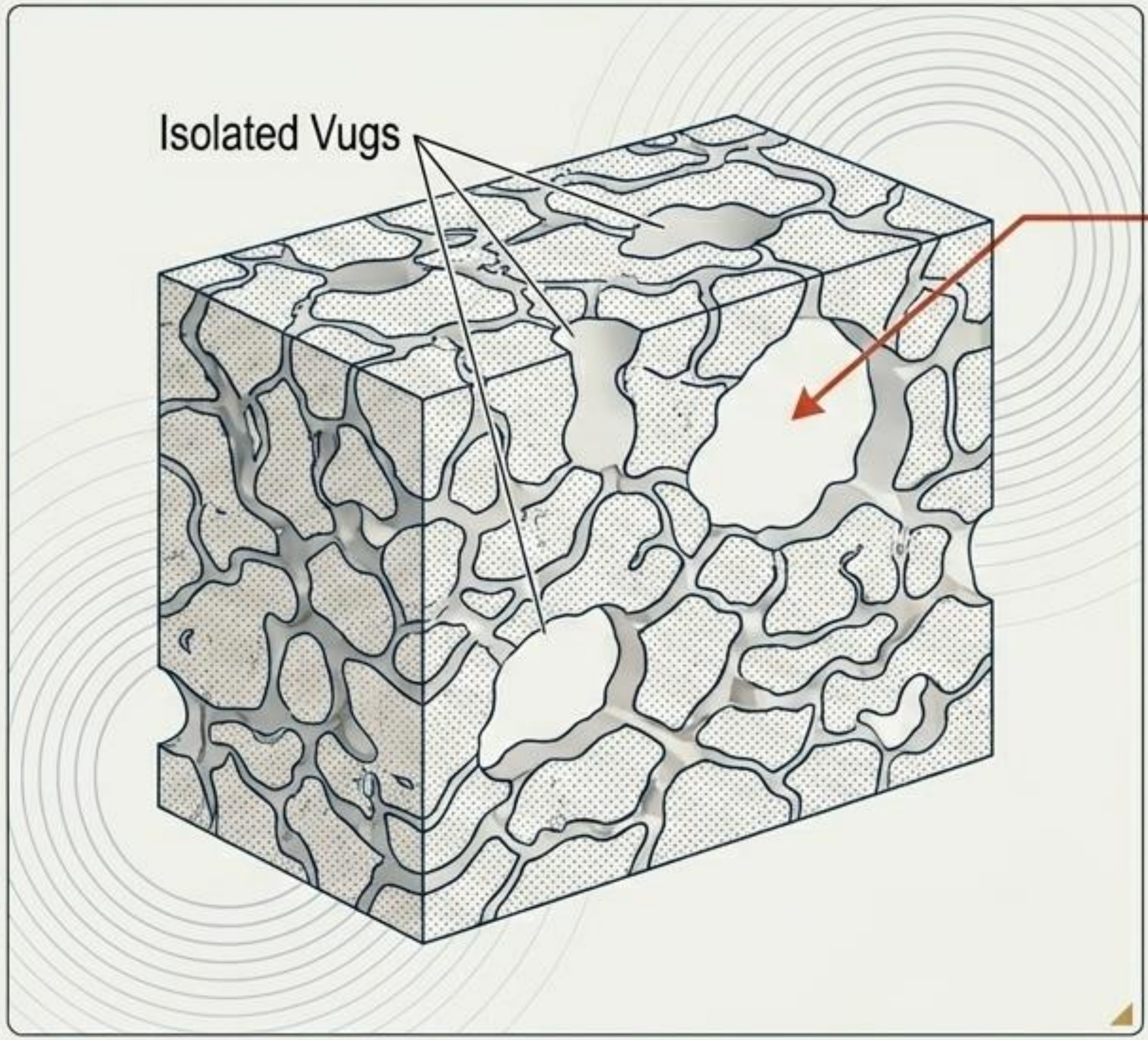
$$K_{\text{SDR}} = a \cdot \phi^4 \cdot (T_{2,\log})^2$$

**Mechanism:**
Driven by the geometric mean of the total T2 spectrum.

**Optimal Use:**
General continuous permeability across standard matrices.



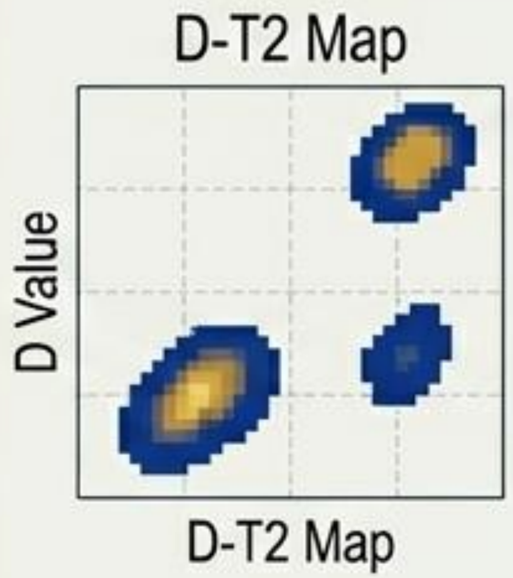
# The Carbonate Complexity: Breaking the SDR Model




## System Alert: SDR Model Failure

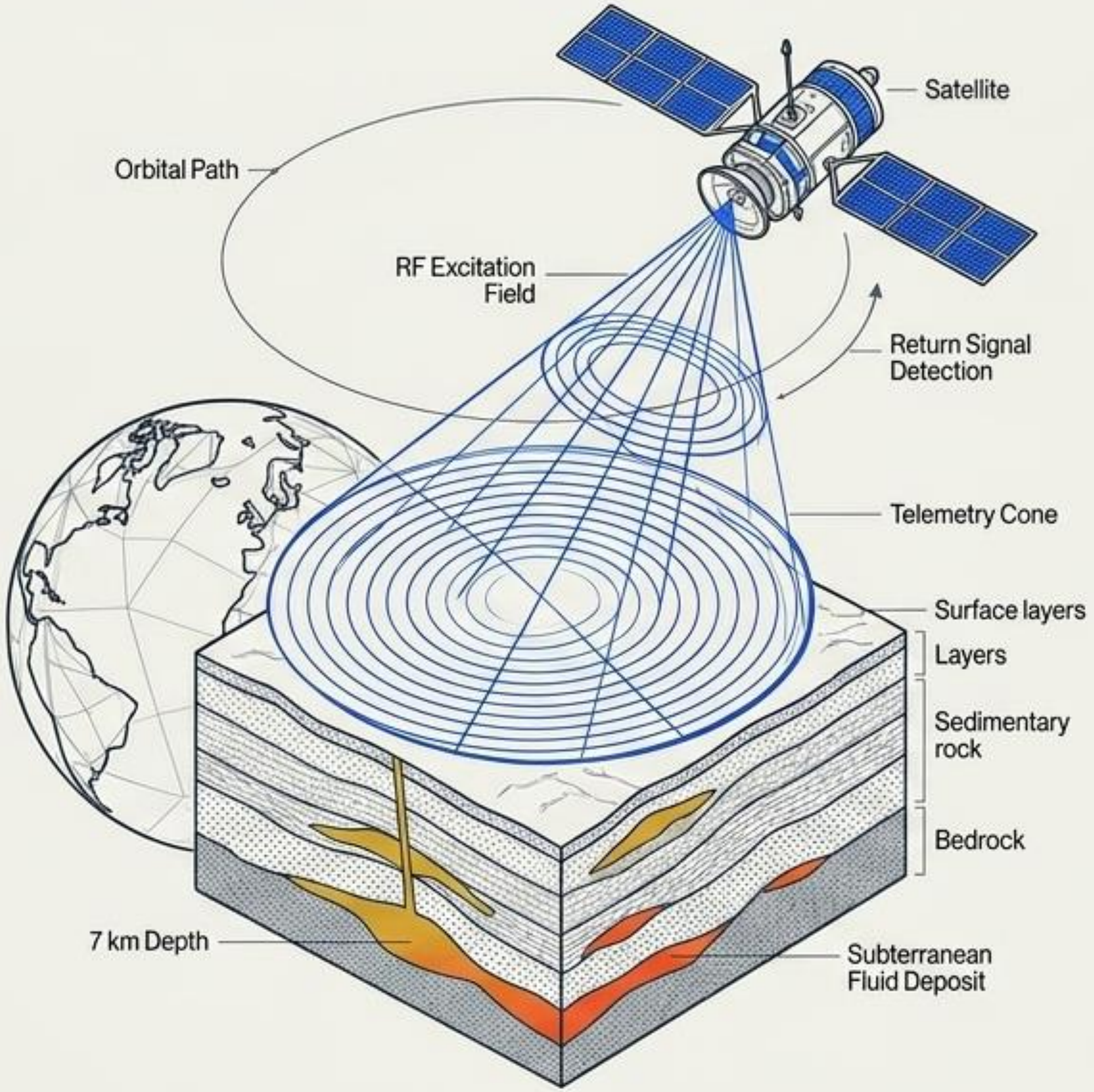
Because fluid in isolated vugs exhibits exceptionally long T2 times, the SDR geometric mean falsely calculates massive permeability despite zero actual fluid connectivity.

## Advanced Parameterization




Resolution requires abandoning static models for Variable T2 cut-offs and multi-dimensional NMR mapping to physically isolate true hydro-connectivity.

# The Macro-Shift: Passive Orbital Surveying (RSS-NMR)




## Core Concept

Combining deep-penetration resonance with hydrogen relaxation physics enables remote deposit marking without surface contact.

## Depth Targeting

$$\omega_0 = \gamma \cdot B_0$$

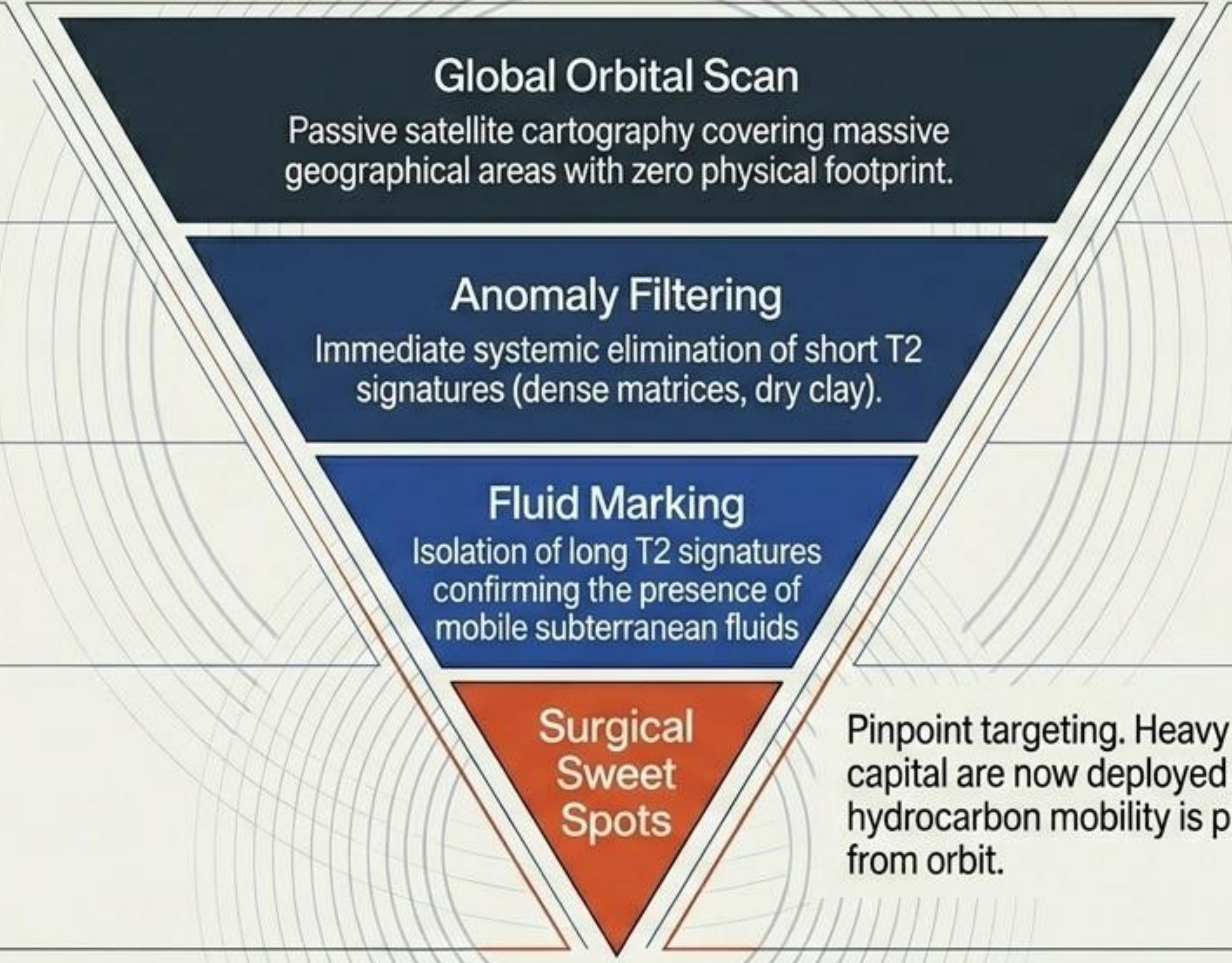
$\omega_0$: Larmor Frequency
$\gamma$: Gyromagnetic Ratio
$B_0$: Static Magnetic Field

Depth calibration is achieved not by physical penetration, but by precise variation of the Larmor frequency. Tuning the frequency determines the exact depth slice of the targeted $B_0$ resonance.

## Detection

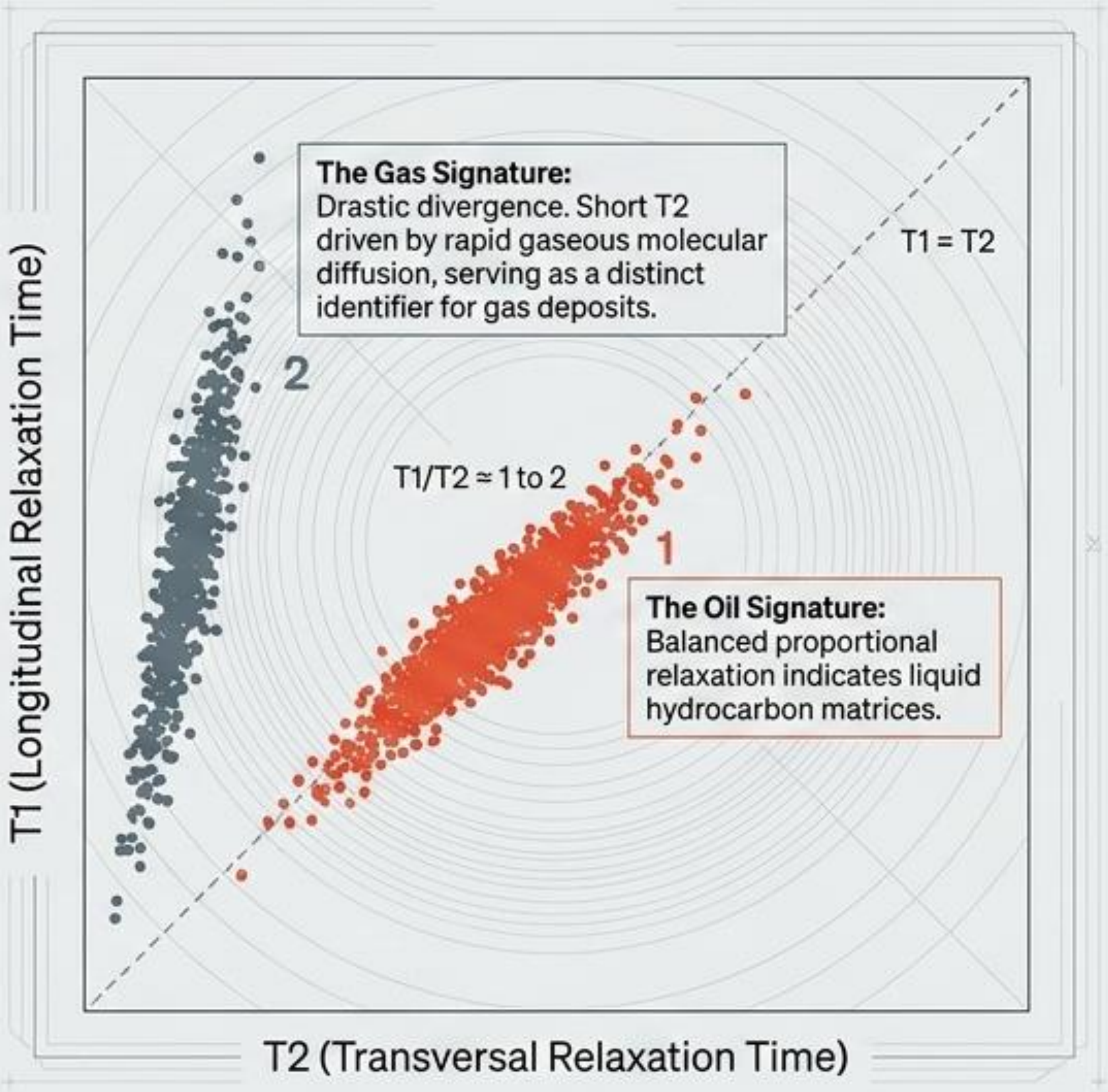
Once the pulse is cut, the spectral signature of the returning RF signal acts as a direct, physical descriptor of the subterranean fluid.

# The Step Zero Methodology




Pinpoint targeting. Heavy seismic and drilling capital are now deployed only where hydrocarbon mobility is physically confirmed from orbit.

# Fluid Characterization Signatures




Takeaway: The satellite does not just find fluids; it reads the intrinsic quantum ratios to classify the resource before deployment.

# The Strategic Value Proposition

## Next-Generation Exploration

### Blind-Cost Elimination

Bypasses the need for systemic, speculative blind seismic acquisitions. Capital is only risked on pre-verified fluid signatures.

### Uninterrupted Brownfield Evaluation

Mature producing fields can be rapidly rescanned for bypassed reserves or deep zones without shutting down existing production infrastructure.

### Zero Environmental Footprint

100% passive, discrete, and invisible orbital operation requires zero ground disturbance during the vast exploration phase.

Made in Russia

Voluntary certification system «Made in Russia»
Registered in the Unified Register of registered voluntary certification systems
Reg. № РОСС RU.31685.04Р2Ш0 from the 24th of May 2017

Система добровольной сертификации «Сделано в России»
Зарегистрирована в Едином реестре зарегистрированных систем добровольной сертификации
Рег.№ РОСС RU.31685.04Р2Ш0 от 24 мая 2017 г

## CERTIFICATE OF CONFORMITY

## СЕРТИФИКАТ СООТВЕТСТВИЯ

**№ CC.002667**

**Valid from** 20.10.2025 **to** 05.10.2028
Срок действия с по

**Applicant/Manufacturer:** Poisk Group LLC, 299040, Russia, Sevastopol, st. Khrustaleva, 143
**Заявитель/Изготовитель:** ООО "ГРУППА ПОИСК", 299040, Россия, г. Севастополь, ул. Хрусталева, д. 143

**Products:** Methodology for calculating predicted ore resources in deep-lying deposits, using the parameters of ore bodies obtained using remote geospace methods of geological exploration and field geophysical equipment of the Poisk complex (FEACN of the CU 9015809100)

**Продукция:** Методика подсчета прогнозных ресурсов руд в глубокозалегающих залежах, с использованием параметров рудных тел, полученных с помощью дистанционных геокосмических методов геологоразведки и полевой геофизической аппаратуры комплекса "Поиск" (Код ТН ВЭД ЕАЭС 9015809100)

**Comply with the voluntary certification system "Made in Russia" requirements.**
**Соответствует требованиям Системы добровольной сертификации «Сделано в России».**

**Certificate is issued on the basis of:** Declaration of conformity company Poisk Group LLC on the Reliability of the voluntary certification system "Made in Russia" dated 07.10.2025 No. 1/GS.
**Сертификат выдан на основании:** Декларации о соответствии компании ООО "ГРУППА ПОИСК" № 1/GS от 07.10.2025 по направлению **"Надежность"** системы добровольной сертификации "Сделано в России".

Made in Russia VCS Holder Russian Export Center JSC; 123610, Moscow; Presnensky municipal district; Krasnopresnenskaya embankment; 12; floor 12; room 1201; e-mail: madeinrussia@exportcenter.ru tel.: +7(495)937-47-47

Держатель СДС «Сделано в России» АО «Российский экспортный центр» 123610, г. Москва, вн.тер.г. муниципальный округ Пресненский, наб. Краснопресненская, д. 12, этаж 12, пом. 1201 адрес электронной почты: madeinrussia@exportcenter.ru тел.: +7(495)937-47-47

**Vice President** / **Вице-президент** — **A.V. Solodov** / А.В. Солодов

003845

---

СИСТЕМА ДОБРОВОЛЬНОЙ СЕРТИФИКАЦИИ «ПРИБОР-ЭКСПЕРТ»
Рег. № РОСС RU.31578.04ОЛН0 от 16.11.2016 г.

## СЕРТИФИКАТ СООТВЕТСТВИЯ

№ [illegible]

Срок действия с [illegible] по [illegible]

№ 0057630

ОРГАН ПО СЕРТИФИКАЦИИ [illegible]

[illegible]

ПРОДУКЦИЯ [illegible]

СООТВЕТСТВУЕТ ТРЕБОВАНИЯМ НОРМАТИВНЫХ ДОКУМЕНТОВ

ИЗГОТОВИТЕЛЬ [illegible]

СЕРТИФИКАТ ВЫДАН [illegible]

НА ОСНОВАНИИ [illegible]

ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

Руководитель органа — [illegible]

Эксперт — А.В. [illegible]

## Disclaimer

The opinions, analyses, and explanations expressed in this text are solely those of their author, Michel Louis Friedman. They do not represent the views of any institution, company, employer, or other entity. The author disclaims all liability for the use or interpretation of this material.




### Michel L. Friedman-Matarese

*(Destom LH 67/11)*

- Mobile: +591-71696657
- WhatsApp: +591-71696657
- Email: michel@geo-nmr.net
- In Charge: Africa & Américas
- Speaker: FR-UK-ES-BR/PT
- GMT: -04h
- Base: Bolivia, Santa Cruz

### Kotelianets Igor

*Director of LLC "Poisk Group"*

- Tel: +78692456491
- WhatsApp: +79787155212
- Email: igor@geo-nmr.net
- In Charge: World
- Speaker: RU-UK
- GMT: +03h
- Base: Sevastopol, Rusia

# VERSATILITY OF APPLICATION





The technology eliminates false positives by identifying the specific type of mineral.