Innovative RSS/NMR technology

Comparison with conventional geophysical methods

Indirect geophysical (seismic) searches for oil and gas and, above all, the identification of traps are a necessary but insufficient exploration stage, since only a third of the structures identified by geophysical methods and verified by exploratory drilling turn out to be be commercial carriers of oil and gas.

Traditional seismic exploration is a geophysical prospecting method that allows us to know in depth the shape and arrangement of the different lithological units. This is possible through the detection, reading and interpretation of seismic waves reflected from the subsurface, produced by an artificial energy source installed at georeferenced depths.

This seismic source is usually a compact high-energy explosive capable of generating an elastic wave that propagates through the subsoil recognizable by sensors (geophones) installed at strategic points in the field of study.

Therefore, the development and introduction into practice of direct methods of searching for deposits of hydrocarbons and other types of minerals in order to effectively assess the prospects for their development at the stage of geophysical exploration are of great importance.

The innovative technology “RSS/NMR” or Resonance Spectral Sensing/Nuclear Magnetic Resonance, which translates as: Spectral Resonance Detection / Nuclear Magnetic Resonance **,** refers to "direct" electromagnetic methods of geophysics and is based on the application of the effect of resonance. The idea of the technology lies in the resonant separation of the spectrum of the substance we need from a mixture of broadband spectra of other substances and many interferences of a different nature. As a result, any type of mineral in areas of any complexity can be explored, that is, searched quickly and reliably.

The simplest analogy of this process to explain how it works is to tune a radio receiver to the correct station among the masses of interfering radio waves and signals from other stations.

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The main thing in our approach to the geophysical study of the earth's interior is that we do not use the interpretation of indirect data, but rather we directly determine the existence or non-existence of the sought substance in the earth's interior and then determine the characteristics of its bed. .

RSS/NMR technology is performed remotely (RSS method) as well as directly on the ground (NMR method). The application of these methods allows regional studies of territories of different area and complexity to be carried out anywhere in the world, their detailed study in any climatic conditions, regardless of epidemics, wars and others that prevent their execution.

The effectiveness of our RSS/NMR technology, compared to 2D/3D seismic surveys, must be considered. The AMAS (South Atlantic Magnetic Anomaly) is a serious limitation for 2D/3D seismic exploration throughout southern Latin America.

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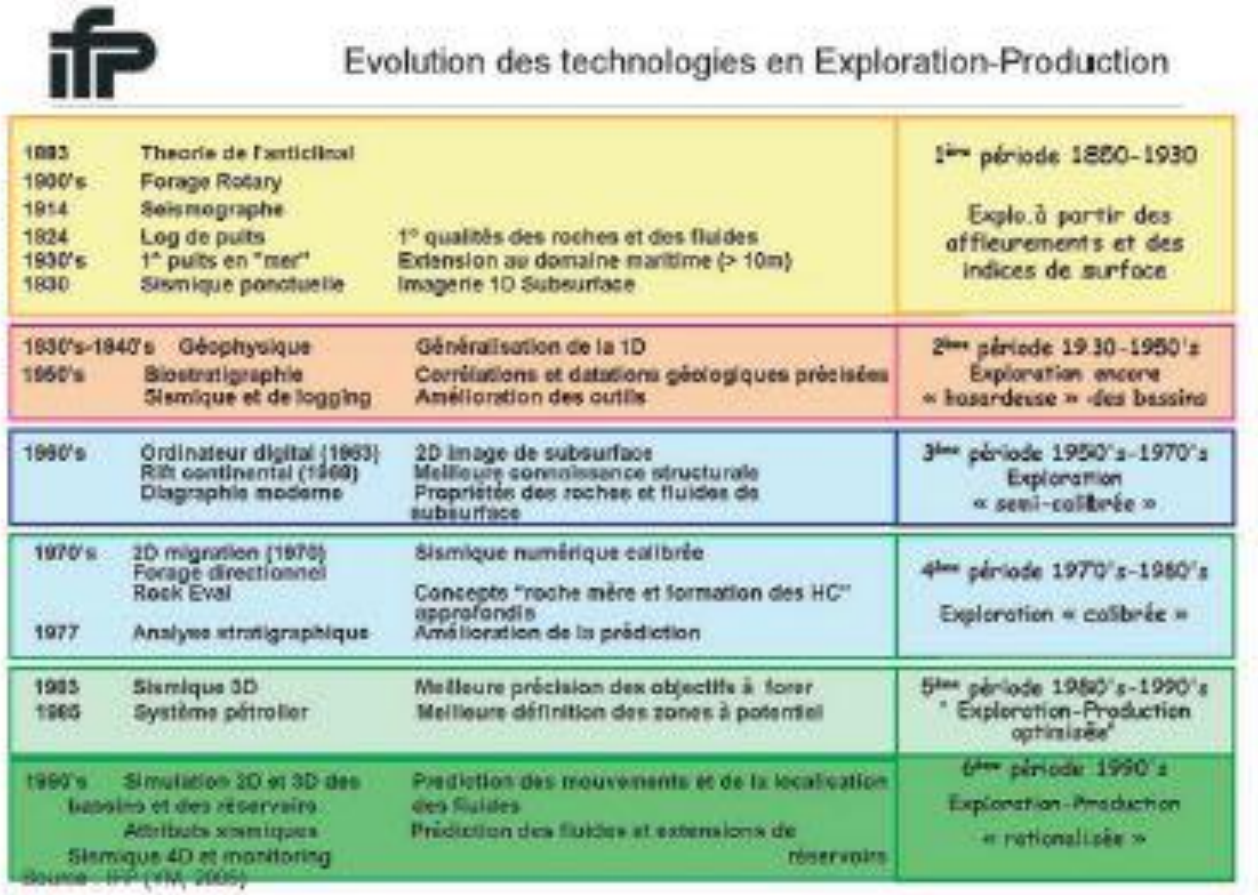
Comparative characteristics of 3D seismic and RSS /NMR technology

Classification	3D	RSS	NMR
Purpose of the study	The main objective of seismic exploration is to find structures favorable to the accumulation of oil and gas.	Identification and survey of deposits in areas up to tens of thousands of square kilometers. Verification and optimization of points for drilling wells. Evaluate the prospects for well rehabilitation.	Study of identified deposits to verify RSS results and establish optimal drilling points in the field. Evaluation of well recovery prospects is the “Brown field refurbish”.
Results obtained	Soil contours of anomalies, fault zones, depths and thicknesses of anomaly horizons, structural maps, expected porosity of reservoirs, 3D models, points for drilling exploratory wells.	Soil contours of deposits, fault zones, depths and thicknesses of deposit horizons, gas pressure, risk horizons, structural maps, 3D models, optimal zones and points for drilling productive wells, reserve calculation.	Soil contours of deposits, fault zones, depths and thicknesses of deposit horizons, gas pressure, irrigation horizons, structural maps, 3D models, optimal points for drilling productive wells, reserve calculation.
duration	From 3 months to 4 years	60 days	60 days
Limitations	It works only on sedimentary rocks.	Virtually no restrictions.	Virtually no restrictions.

	Detects mostly traditional dome traps. Does not work in shallow water and mountainous terrain. Long duration of the base phase of studies and data interpretation. Difficult to study in difficult geographical, climatic, social, political and epidemiological conditions.	Works on sedimentary and hard rocks. It works in deep offshore waters (up to 6 km from the surface). Highlights the tanks of any structure. Used in any geographical, climatic, geological and epidemiological conditions.	Works on sedimentary and hard rocks. It works in deep offshore waters (up to 6 km from the surface). Highlights the tanks of any structure. Used in any climatic, geological and epidemiological conditions.
Environment _	A large vibration load and the need to cut trees and affect the environment.	Absolutely environmentally friendly. Safe for people and the environment.	Absolutely environmentally friendly. Safe for people and the environment.
Effectiveness	30% on Green Fields, up to 50% on additional field exploration.	More than 90%.	More than 90%.
Cost	high	reduced	reduced

Symbolically, the difference between the technologies is illustrated in the following figure:



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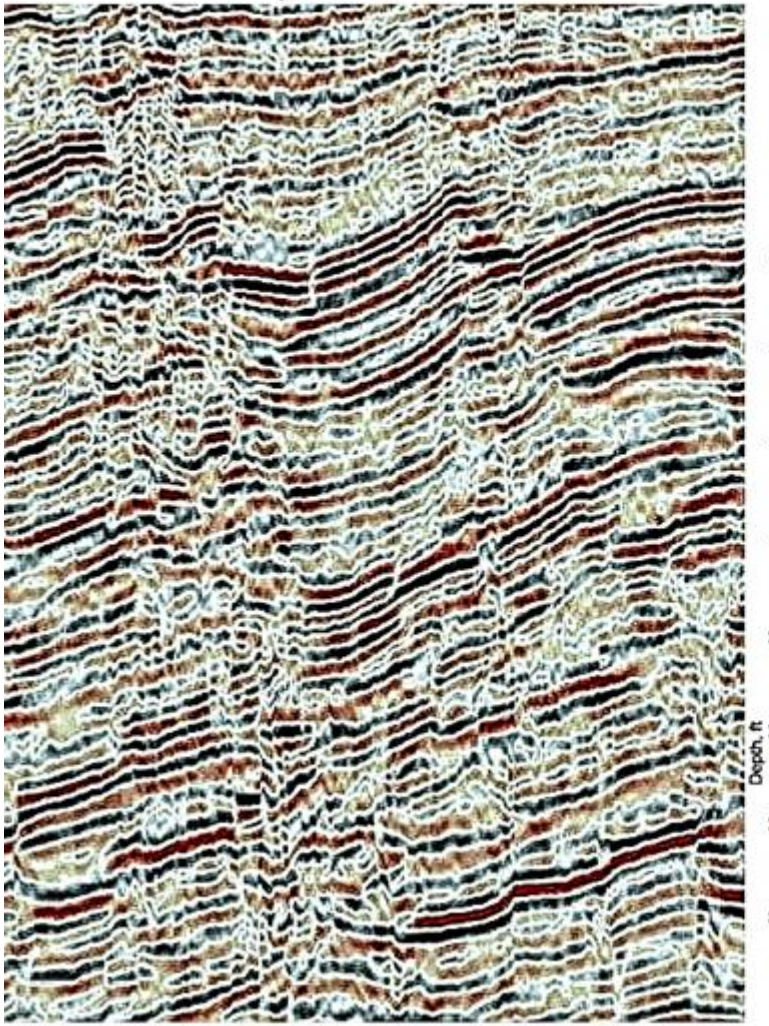
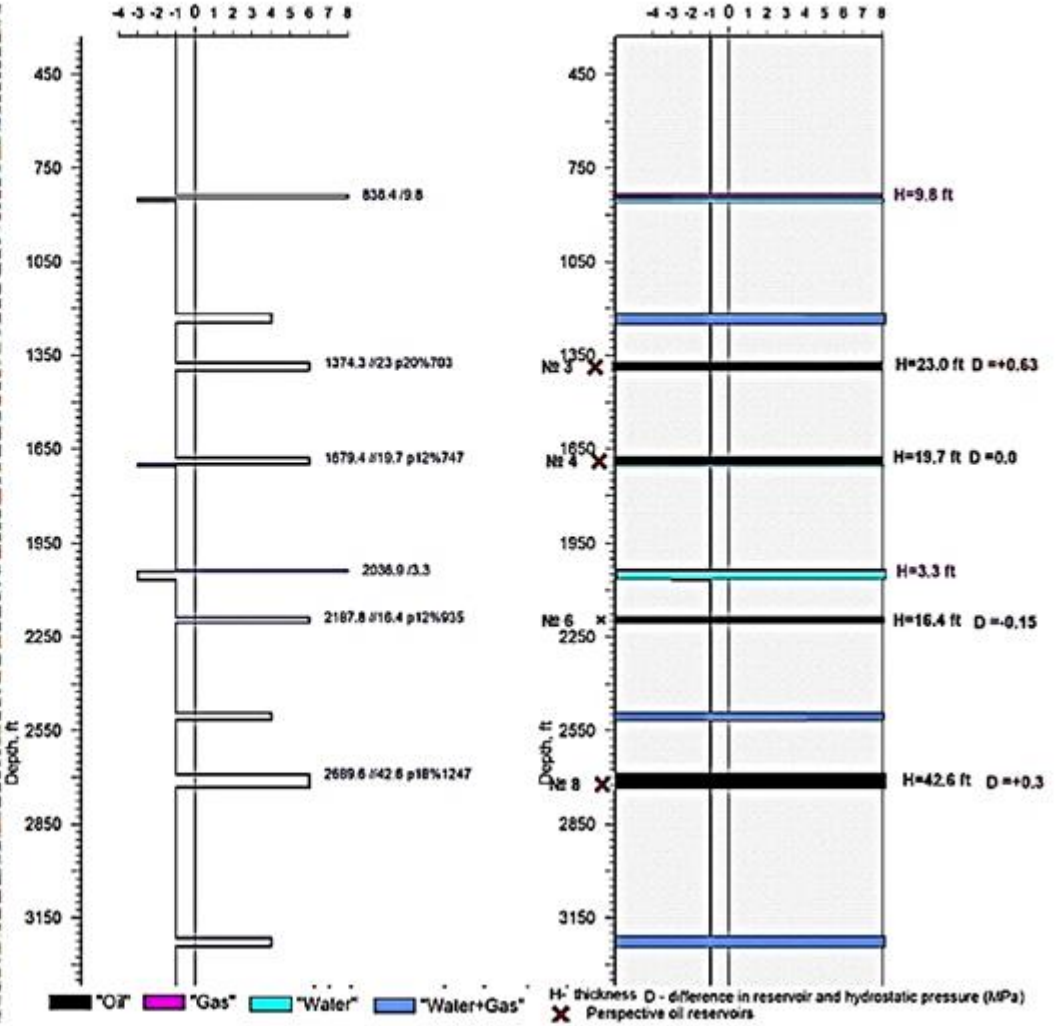
Como la RSS-NMR y las sismicas clasicas muestran los resultados de terrenos

Sismica , una larga interpretacion es necesaria



RSS-NMR lectura directa de los resultados , sin interpretacion



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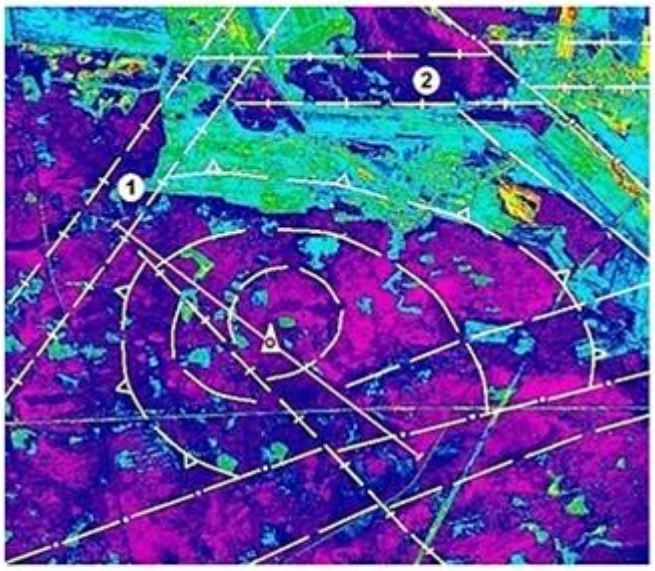
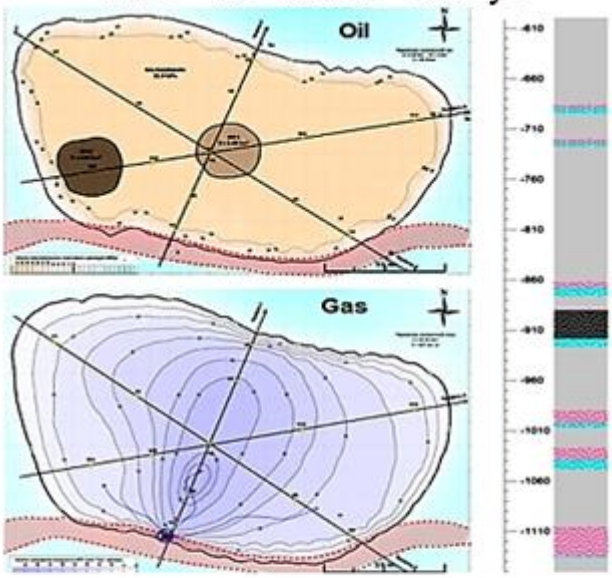
Comparison of RSS/NMR with ERS (European Remote Sensing Satellite)

Terrestrial remote sensing is a non-contact study of the Earth, its surface and subsurface, individual objects and phenomena by recording and analyzing their own electromagnetic or reflected radiation. ERS spatial remote sensing systems make it possible to receive data from large areas, which can then be used to forecast territories, promising the occurrence of various types of minerals and water.

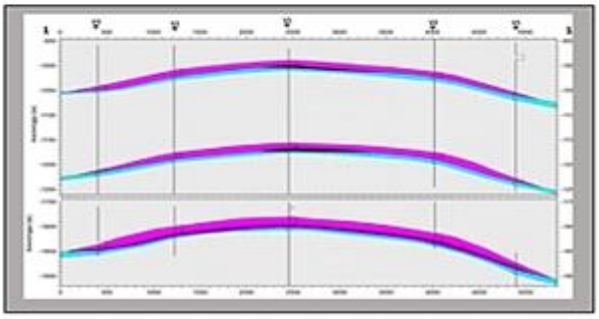
ERS - oil prospective zones

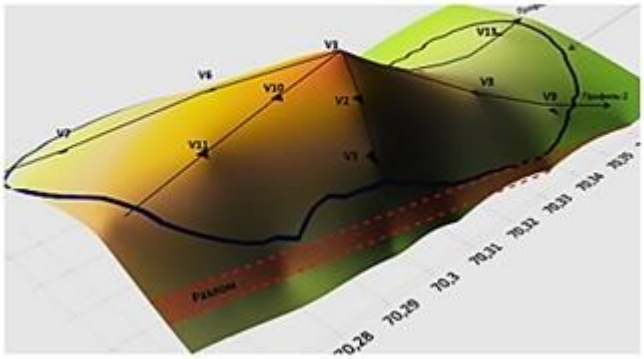


RSS - 2D and 3D surveys



ERS - terrestrial mineral displays





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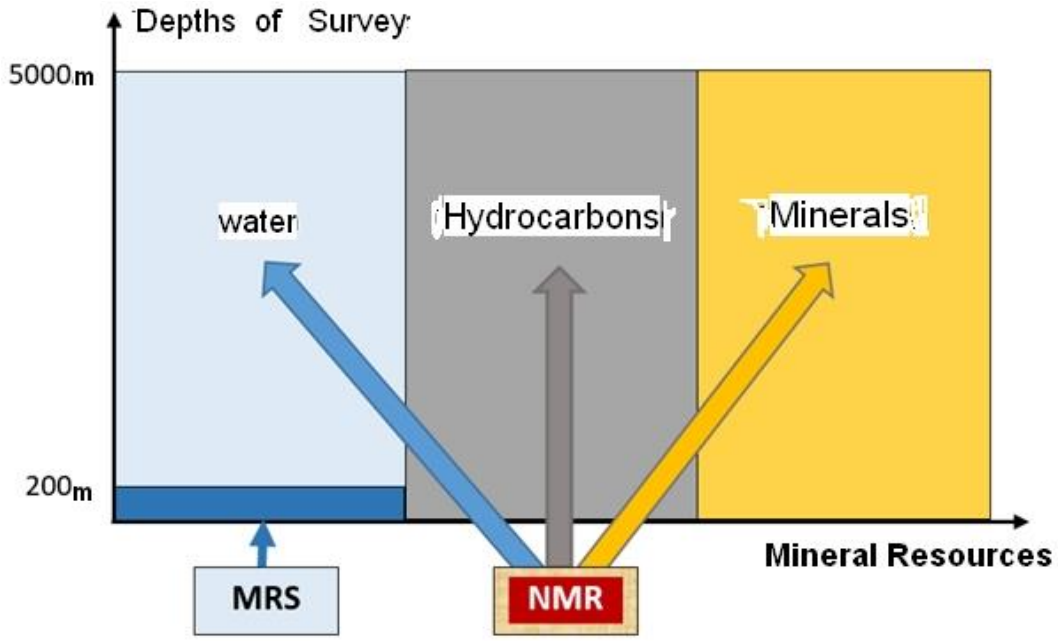
We can see a big qualitative difference in the results of the studies. ERS identifies promising areas for additional study; RSS identifies deposits and determines their specific characteristics and depth of occurrence.

Comparison of RSS/NMR with MRS (Magnetic Resonance Sounding)

MRS technology is designed to detect aquifers and measure their characteristics. The principle of operation of the compared MRS and NMR technologies is the same and is based on the phenomenon of nuclear magnetic resonance. However, MRS requires very large antennas and enormous maximum power to penetrate 150 to 200 meters deep. In this case, only the water horizons are detected, while NMR detects water, hydrocarbons and minerals, carrying out the study at greater depths:



Therefore, RSS technology is a remote method of area surveying, directly identifying water, hydrocarbons and minerals sought and providing in-depth exploration and evaluation of development prospects.

Conclusions on the results of the comparative analysis of technologies.

The efficiency of geophysical technologies and methods consists of the reliability of the study results, the speed of obtaining them and the cost.

In all these parameters, RSS/NMR technology significantly outperforms any of the geophysical methods discussed above and therefore radically increases the

profitability of companies exploring and producing hydrocarbons, fresh groundwater and minerals. In these times of uncertainty, the reconditioning of mature fields (Brown Field) is the key to success for a company in the exploration phase.

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