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Advances in the Realm of Exploration Geophysics: The Emerging Role of Quantum Geoelectrophysics in Exploration for Hydrocarbons, Minerals and Water

Gerald J. Gurba, BSc., P. Geol.
Integrative Technologies International Inc.

Richard Hatala, B.A.Sc., P. Eng., PMP
Integrative Technologies International Inc.

Summary

The use of classical geophysics such as seismic, gravity, magnetics, and resistivity to explore for hydrocarbon resources, minerals and water has been the industry standard for many decades. These technologies have proven quite effective to late 2014 within the context of high commodity prices. However, newer remote sensing and ground-based technologies are now emerging with the ability to significantly reduce costs and time, and increase success for hydrocarbon exploration and development programs globally.

Hydrocarbons are integral to our local, regional and global economy and will be for decades to come. Since the oil price collapse in late 2014, the energy industry has been stressed with significant loss of experienced personnel, reduced service and material capacity, and declines in viable go forward projects in a geopolitically induced low commodity price environment. Water is integral to our economy, the health of our environment, and our survival as a species. Much of this water is accessed from surface sources, mostly rivers, which are now coming under increased threat due to over use and hydro-political forces. To meet these fundamental issues and challenges, innovation in current traditional and conventional technologies and methodologies for exploration and development of hydrocarbons is required.

Direct Matter Indicator (DMI) technologies, or applied methods of Quantum Geoelectrophysics (QGEP), are poised to revolutionize the exploration geophysical industry, much like 3D and 4D seismic did so many years ago. DMI utilizes resonant frequency remote and direct sensing technologies that detect perturbations in the earth's natural electric and electromagnetic fields. Controlled source electromagnetic pulse methods with electromagnetic spectrum spectroscopy are used to identify hydrocarbon reservoirs type (oil, gas, condensate), area, intensity (concentration), temperature, pressure, formation depth and thickness accurately. With multiple successes around the world, the deployment of this inventive and effective approach to hydrocarbon exploration in North America is occurring today.

This presentation will discuss the basis of DMI technologies and showcase some of the benefits and examples this emerging exploration tool can provide to hydrocarbon, mineral and water exploration and development efforts globally.

Background

Quantum Geoelectrophysics is an emerging field (over the past 35 years) of geophysical theory and practice. QGEP utilizes electric fields, magnetic fields, and electromagnetic techniques; combined with

Electromagnetic Spectrum Spectroscopy and Resonant Frequency analysis and processing to identify the natural resource or type of substance, area, location, intensity, depth, thickness, and volume within specific sub surface formations and areas of investigation.

DMI Technologies are based on the principle of electromagnetic resonance that allows for direct identification of different types of matter at depth. These technologies have been researched, developed, field tested and applied over the past twenty (20) years to remotely sense (via satellite target substance emissivity) or directly sense (via area intensity) on the surface and sub-surface (via vertical scanning or virtual wells), hydrocarbon reservoirs, mineral deposits and water aquifers with accuracy. The result of the application of Quantum Satellite, Area and Vertical Technologies is a three-dimensional perspective of the reservoirs, deposits or aquifers, enabling estimation of the oil and natural gas, minerals or water resources in place. Quantum DMI Technologies have been successfully applied in over 50 countries in the world and have no negative environmental, ecological or cultural impacts. Quantum DMI Technologies can be applied onshore and offshore with the ability to detect target substances over difficult terrains such as deserts, swamps, snow, ice-fields, mountains, within crystalline rock for minerals and within or below salt, basalt, granite and metamorphic rock.

In Quantum DMI Technology, all matter, all elements and all substances have a unique electromagnetic resonant frequency (EM RF). A library of EM RF signatures for over 100 primary elements and substances has been empirically determined and are utilized in all three applications of resonant frequency remote and direct sensing technologies: Quantum DMI Satellite, Area and Vertical Surveys.

1) Quantum DMI Satellite: The EM RF emissions from a target substance are detected and measured from satellite data then processed utilizing multi-spectral analysis and EM RF interpretation. The interpreted results are then presented as a 2D map showing the Quantum hydrocarbon anomaly, or mineral anomaly, or water anomaly, areal extent (km^2), intensity (EmV), maximum reservoir pressure (MPa), type of fluid or material (oil, condensate, gas, gold), and tectonic faults and fractures in the area of investigation. Vertical Scanning Simple (VSS) and Detailed (VSD) can be applied to the Quantum Anomalies to yield the depth intervals and formations, temperature where the cumulative intensity level at a point on surface is originating. Satellite Surveys are conducted from 1:200,000 to 1: 1,000 scale depending on the type of geologic objects being investigated and Client specifications (see Figure 1).

2) Quantum Area Intensity Surveys: Area Surveys are conducted from an aircraft, vehicle, vessel or on foot by a 4-6-person team. Whereas Satellite Surveys yield the relative Quantum Anomaly intensities, “ground truthing” Area Intensity Surveys allow measurement of the absolute value of the target substance EM field intensity, as well as positioning the anomaly with a high degree of accuracy on the earth or sea. The result is an intensity contour map showing the locations of the highest EM RF of the target substance (see Figure 2).

3) Quantum Vertical Surveys: Vertical, Virtual or “Electronic” wells use the generation of rapid EM pulses into the near earth field via a “T-Wave” with measurement of the resonant response for the target substance on the surface. This allows determination of the depth, thickness, intensity, temperatures and pressures of individual zones vertically. This electromagnetically acquired log of the well is recommended to be electronically “drilled” or a Quantum Vertical Survey conducted, prior to a physical well being drilled. The Vertical Survey can discretely detect 1 m of hydrocarbon pay zone in a 5,000 m well depth due to the T-Wave being congruent and coherent (like a laser) as opposed to diffuse (like a flashlight). Quantum Vertical Surveys are also conducted with a 4-6-person field team (see Figure 3).

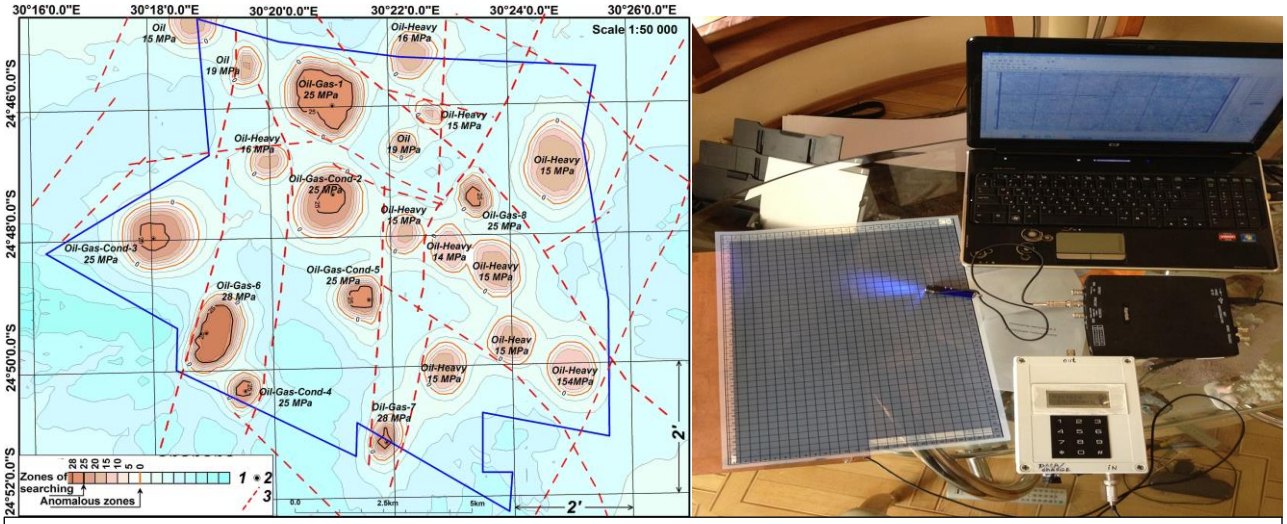
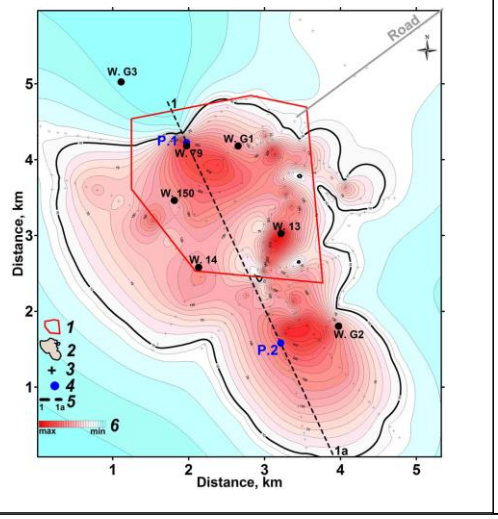


Figure 1: DMI Satellite Technology: On the left is an example of an Oil, Gas, Condensate Satellite Survey at 1:50,000 scale. On the right is the equipment utilized for raw Sat. Data RF processing, analysis, interpretation and presentation.



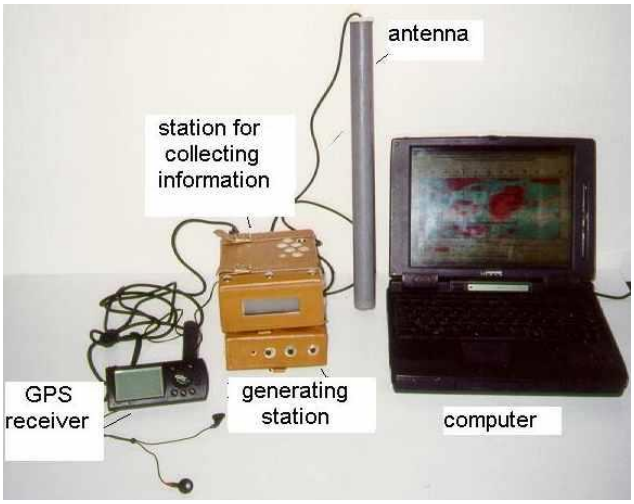
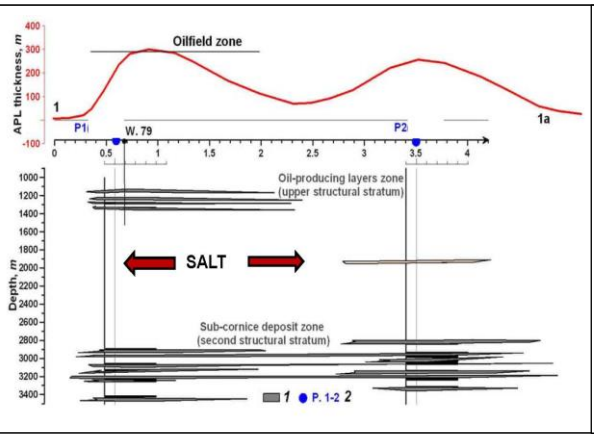


Figure 2: DMI Area Technology: On the left is an example of an Oil Area Survey showing intensity contours of the EM RF of an oil pool. On the right is the equipment utilized in field data acquisition, analysis and interpretation.



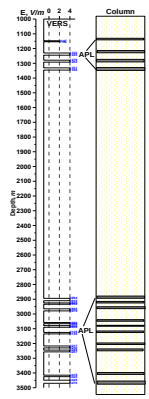


Figure 3: DMI Vertical (Virtual Well) Technology: On the left is the APL (Anomalous Polarized Layers) in meters of the Oil QHAs above and the Vertical Technology associated with P1 & P2 below. In the middle is a figure showing P1 Log analysis of depth and thickness of the Quantum anomalous oil zones. On the right, is the field equipment for data acquisition; source of T-Wave or EM Pulse, antennae for capturing the response, generators, and flux field analyzer.

DMI Technologies are more efficient, effective, repeatable, reliable, robust and economic than utilizing traditional technologies alone. Quantum technologies are ten times more effective, at often less than one tenth the cost, thereby reducing the upfront risk and full cycle finding and development costs associated with traditional oil and gas, mineral and water exploration and development with little to no environmental impact

By utilizing Quantum DMI Technologies, the integration of traditional, conventional and quantum exploration and development technologies and methodologies in a framework we call the Integrative Exploration Model (IEM), are more effective, efficient, economical and environmentally friendly than current traditional technologies alone.