ABSTRACT

Since 1991, Geo Vision, Inc. (GeoVision) has placed a high priority on technical innovation of its GeoVision Geological Direct Detection Radiometric and Air-Gamma Technology (GeoVision technology). Through its proprietary service and survey method, and with its ability to assist in the exploration and discovery of oil, gas, and gold deposits, a GeoVision survey consists of three phases: Phase 1 is preliminary identification of anomalous deposits; Phase 2 is field expedition (usually, a helicopter survey of the area) and data processing; and Phase 3 is final reporting and drilling recommendations. Since 2004, scientists from the R&D department of GeoVision have developed the survey equipment and a method for the discovery of geothermal fluids. From 2007 through 2010, GeoVision conducted four (4) geothermal surveys in Nevada, USA for Gradient Resources Inc. (GRI). All four surveys have been successful. At one (1) of the GRI geothermal prospects, the Patua Geothermal Prospect, GRI has already drilled observation, production, and injection wells which coincide with GeoVision anomalies and has proven geothermal fluids for a 60 MW power generation facility. At GRI’s Colado and Aurora Geothermal Prospect, the GeoVision anomalies occur at locations where high temperature thermal gradient anomalies and exploration wells have been drilled.

Introduction

In its time, the A.F. Okhatrin Laboratory in Moscow found several experimental effects, which formed the foundation for the GeoVision technology. However, theoretical justification for these effects that is accepted by fundamental science did not exist previously, and does not exist today. At this time, similarly more than 400 elementary subatomic particles “exist” (accelerons, gluons, etc.); however, no practical confirmation has been found for them yet.

Keywords

GeoVision, satellite imagery, geothermal exploration, well locations, conceptual model

Basis of GeoVision Technology

All elements, for example of the Earth’s crust, exist in an excited state and are constantly emitting what could be called their “intrinsic radiation”, which forms cluster and macro-cluster field structures. Such macro-cluster structures, which are sometimes observed as a result of polarization above the Earth’s surface, are described in US Patent 4005289, 250-252, 1976, and have been recorded above an oil field from a satellite traveling in orbit. As practice has shown, such cluster structures, which apparently have a spherical shape initially, form something of a pear-like shape, apparently as a result of gravitational and other effects (see Figure 1). Thus, “prominent” directions of propagation no doubt exist. Furthermore, as practice has shown, clusters vary in terms of their structure, which apparently reflects the variegation of the natural formations.

When the surface of the Earth is photographed from space, the halide of the emulsion layer of the photographic film records not only an image of the terrain in the visible optical spectrum, but also the effect of manifestation of energy clusters formed by natural objects as a result of their polarization above the surface of the Earth. The physical/informational foundation of the method of prospecting for underground resources based on the theory of
energy-information exchange in geosystems of various levels and types is the property of substances of exhibiting a dipole field when placed in an electric field (for example, Balasanyan, 1990).

A natural formation constitutes a geophysical waveguide, consisting of emitters of different magnitude, which are excited by a broad spectrum of active frequencies, and thus, each of the emitted waves of naturally induced polarization has its own amplitude, frequency, and phase. As a result of their interaction, each natural formation will form, on the observation surface, an interference image of its total field of natural polarization, with a spatiotemporal structure characteristic of the object. In this way, the spatiotemporal structure of a wave field of naturally induced polarization of energetically active natural formations presents an image of the material/energy structure of natural objects on the earth surface.

A GeoVision survey consists of three phases: Phase 1 is the preliminary identification of anomalous deposits on satellite photographs; Phase 2 is field expedition (usually, a helicopter survey of the area) and data processing; and Phase 3 is final reporting and drilling recommendations.

**Phase 1 of a GeoVision Survey**

The first phase is based on the well-known effect of a photochemical reaction in halide microcrystals which occurs under the influence of electromagnetic waves (of the visible, infrared, and ultraviolet spectrum), as well as the effect of charged particles (recording of rare events). The conclusion is that halide reacts both to particles and to waves.

Visualization of the natural formations being searched for (the 1st stage of the GeoVision process) is achieved as a result of the resonant expression of information carried by the emulsion layer of the photographic film, and an optical-subatomic filter tuned to a specific chemical element or compound thereof (gold, petroleum, gas, hydrothermal sources, etc.).

Despite the similarity of chemical composition, the “intrinsic radiation” spectrum has several differences, which make it possible to distinguish the carbon of natural coal from the carbon of diamonds, etc.

The first phase of the GeoVision process allows one only to establish the fact of whether the target underground resource is present in the surveyed territory and how it is territorially confined. In other words, the first phase of a GeoVision survey consists of the preliminary identification of anomalous deposits and involves the following:

1. Collect data from the area using a real satellite survey pictures or scanning the area with aircraft traveling at low speed using a Geo-SCAN ML1P scanner to identify prospective areas.
2. Process collected information by using a special software program to identify the location of anomalous deposits.
3. Analyze information and narrow survey areas to include anomalous prospective parcels of land, which will be recommended for the second phase helicopter survey.

**Phase 2 of a GeoVision Survey**

The second phase of a GeoVision survey consists of a zigzag helicopter, or ground transport, survey to better define the location and areal extent of the anomalous deposits as well as the depth to the productive horizons in the subsurface. In other words, the 2nd phase consists of the following:

1. Field expedition with measuring the anomalous deposits using GEO-SCAN ML2, installed onboard a helicopter or, in some cases, if areal extent of the survey is small on ground transport.
2. Processing of created images to identify the model for the field of anomalies in order to create digital imaging of the fields, their intensity and areal extent, for the construction of mathematical and cartographic models of the deposits.
3. Development of the digital outline of the anomalies, using mathematical and cartographic resources, for construction of the spatial model of the deposit and preliminary estimation of the reserves.
Phase 3 of a GeoVision Survey

The third phase of a GeoVision survey consists of the analysis of all of the anomalies detected during the completion of the 2nd Phase helicopter expedition. The scale of the intensity of intrinsic emissions using GeoVision technology is indicated in four colors, which correspond to the following gradational characteristic for the specific anomalous areas being investigated. The probability estimates presented below for the four colors are of statistical significance for GeoVision surveys conducted for oil and gas, gold, fresh water, and other mineral deposits, not specific statistical significance for geothermal anomalies since only four GeoVision surveys have been conducted in the western U.S.

Group #1, Color red – outline areas with maximum intensity of intrinsic emissions and with a probability of approximately 90% for obtaining productive high temperature geothermal fluids with significant flow rates.

Group #2, Color light or dark blue – outline areas with 60% forecasted probability of finding producible high temperature geothermal fluids.

Group #3, Color green or orange – outlines areas with 30% forecasted probability of finding producible high temperature geothermal fluids.

Group #4, Color yellow – describes area of the cluster of intrinsic emissions considered as background with the possible presence of geothermal fluids with a probability of ~5%.

GeoVision Case Histories

The Patua Hot Springs (Patua) geothermal project is located approximately 38 miles east of Reno and about 10 miles east of the town of Fernley at an elevation of about 4,050 ft near the southern end of the Hot Springs Mountains. Surface manifestations of geothermal resources include thirteen hot springs with...
temperatures from 82°F to 204°F, hydrothermal alteration, and silica sinter deposits. The results of the Phase 1 stage GeoVision survey of the Patua Geothermal Prospect are illustrated in Figure 2. However, the Phase 2 helicopter survey is restricted to a more limited area and the resulting data are presented in Figure 6 with the locations GRI production or future well.

Three of the GRI Patua production wells, 21-19, 23-17, and 37-17ST1 have been drilled into the color red maximum intensity GeoVision anomalies. Each of the wells has had maximum temperatures of >300°F at depths of ~10,000 ft, verifying the geothermal resources indicated in the GeoVision anomalies. The 21-19 well was directionally drilled to the GeoVision anomaly. The future well drilling program at Patua will be programming the completion of additional production wells in the anomalies.

Two additional GRI geothermal prospects, Colado and Aurora, have been explored using GeoVision surveys. During the 1970s and 1980s, these two prospects were explored by Getty Oil Company and Phillips Petroleum Company/Arco Oil and Gas Company (ARCO), respectively. Even though GRI has not commenced their exploration and production drilling programs at these two prospects, the shallow, intermediate, and deep drilling data provided by Getty and Phillips/ARCO indicated that the GeoVision anomalies coincided with the areas of high temperatures identified earlier by Getty and Phillips/ARCO.

The Colado Geothermal Prospect of Vulcan Power Company (Vulcan) is located in south-central Pershing County, Nevada, approximately 7 miles northeast of Lovelock, Nevada, about 120 miles northeast from Reno. The Colado Prospect is 43 miles northeast of the Brady’s Hot Spring Geothermal Plant. Like the Desert Peak Geothermal area 40 miles to the southwest, there are no known surface indications of a geothermal resource, but water wells and mine shafts in the area suggest that one exists at Colado and it has been explored by Getty.

At GRI’s Colado Geothermal Prospect, Getty drilled nineteen (19) thermal gradient holes of ~500ft total depth with a maximum measured temperature of 236°F, two intermediate-depth stratigraphic boreholes, and a 8,000ft exploration well in Section 10, which indicated temperatures >325°F at depths of less than 8,000ft. The wells in Section 10 coincide with GeoVision anomalies (see Figure 7). The GeoVision anomalies also coincide with high temperature thermal gradients in Section 34, T28N, R32E, and in Section 3, T27N, and R32E.

The Aurora geothermal prospect is located about 30 miles southwest of Hawthorn, Nevada, and approximately 160 miles southeast of Reno, Nevada. The Aurora area has been a significant gold and silver mining district since the mid-1800s. Phillips/ARCO defined the Aurora geothermal anomaly in the late 1970s, drilling thirty (33) shallow- to intermediate-depth geothermal temperature gradient wells that are between 63 and 920ft deep with maximum temperatures of 124°F, and a stratigraphic test well drilled in April 1981 to 1,741ft with a maximum temperature of 224°F. The Phillips shallow temperature gradient wells identified an area of over 18 square miles with a temperature gradient in excess of 8°F/100ft.

Extrapolation of these temperature gradients at the Aurora Geothermal Prospect suggests that temperatures at depths between 4,500 and 6,000ft could exceed 390°F and could be as high as 490°F. After completion of the stratigraphic test well, Phillips proposed a plan of operations to drill up to three additional stratigraphic test wells and three deep exploration wells to 6,000ft or less with expected temperature >450°F.

The results of the Phase 1 stage GeoVision survey of the Aurora Geothermal Prospect are illustrated in Figure 8. As a result of conducting the first stage of work using GeoVision technology on the Aurora tract, shown in Figure 8, prospective areas were identified (in blue) – which were taken to be the areas with maxi-
mum intensity of specific emissions of hydrothermal water – for conducting further field investigations by helicopter (see Figure 9).

The flight paths (Figure 10) at Aurora were determined using Ozi Explorer navigation software. In the process of inspecting the Aurora prospect by helicopter and taking into account the nature of the signals being picked up by the GV detectors, the flight paths were adapted in real time to the existing conditions.

Based on the data obtained during the aerial scanning stage, a thematic map of the Aurora prospect was created (Figure 11). Thematic map signifies a type of electronic map which shows the structure and form of the target geothermal anomalies and their zoning based on intensity of distribution of specific emissions.

The GeoVision anomalies identified at the Aurora Geothermal Prospect coincided with the area of over 18 square miles Phillips identified with thermal gradients in excess of $8^\circ$F/100ft. The areas

Figure 9. Helicopter at Aurora ready to conduct Phase 2 of GeoVision survey.

Figure 10. Actual GeoVision flight paths at the Aurora Geothermal Prospect.

Figure 11. GeoVision anomalies at the Aurora Geothermal Prospect, Nevada.

Figure 12. Pictorial presentation of the GeoVision technology, with description of the seven stages presented below.
of highest intensity of the GeoVision anomalies coincide with the locations that Phillips had proposed in their plan of operations submitted to the U.S. Bureau of Land Management to drill three deep exploration wells to 6,000 ft.

**Conclusions**

The following are the condensed version of the seven stages of the GeoVision technology applied to geothermal exploration and drilling:

1. “Assemble” satellite analog pictures for the area to be evaluated.
2. Special laboratory method to identify individual emanations from geothermal fluids.
3. Geothermal, i.e., heat anomalies are identified on the digital satellite film.
4. Field survey consists of flying helicopter over identified geothermal anomalies.
5. Field expedition survey result and coordinates of geothermal anomalies are presented on maps.
6. Varying depths and temperatures of the geothermal fluids with recommended drilling locations.
7. Drilling at the identified GeoVision anomalies with anticipated highest temperatures.

**References**

Primary references are internal confidential Gradient Resources Inc. (GRI) data and reports.