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REPORT
GEOCHEMICAL SOIL GAS SURVEY FOR HELIUM AND HYDROCARBONS CISCO SPRINGS AREA, UTAH

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1. Summary

The objectives of the helium/HC survey were met: 1) Define potential areas of helium accumulation; and (2) define areas of petroleum accumulation for further field development.

The sampling program consisting of 323 sample points was conducted on a grid basis at three locations, A, B and C. All predetermined grid locations were sampled but some points required minor offsetting because they fell in inappropriate places such as cliffs and thorny bush areas. Sampling was conducted by truck over flat areas, and by walking and ATV over more rugged areas. The samples were shipped to Petro-Find's lab in Saskatoon for analysis by a state-of-the-art micro-GC for helium, hydrogen and neon as well as a gas chromatograph equipped with an auto sampler for hydrocarbons and CO2. All contour and bubble maps and interpretation of data were conducted in Saskatoon.

The outstanding feature of the geochemical soil gas survey was the discovery of a major helium anomaly associated with nitrogen that is about 421 acres in size at the 5.5 ppm level and open in all directions in Area B (Prospect #1). Big rig drilling is recommended (see recommendations below).

Four other significant helium multi-anomaly prospects associated with petroleum gases were discovered in Area A including Prospect #2 estimated to be about 375 acres in size. At the 5.5 ppm level almost the whole of Area C1 was found to be anomalous. In Area C1, helium Prospect #6 consists of four helium anomalies of medium quality that are open in all directions. All helium anomalies, except Prospect #1, will need to be confirmed by infill surveys and most can be extended beyond the borders of the current survey.

Three petroleum systems were detected in the project area: heavy oil, light oil with associated condensate and rich gas, and dry gas. The heavy dark oil detected is Pennsylvanian that is probably sourced from the Phosphoria formation and perhaps the Hermosa formation; the light oil is sourced from the Dakota Formation (Information source: communication with Tedesco). Stable isotope analysis of carbon and hydrogen of the methane in the dry gas would be a first step in identifying its origin.

The methane/ethane ratio (C1/C2) and C2+ were used extensively in this report to determine gas and oil prone areas and prospective reservoirs in Area A. They were not as useful for Areas B and C because of heavy biodegradation of ethane. Ethane was absent in 24 % of samples in Area A, 54% in Area B and 83% in Area C. Apical anomalies were found to exist over heavy oil/ light oil reservoirs and halo over condensates/rich gas reservoirs.

Hydrogen was used to locate light oils with associated condensate and rich gases. Its lightness allowed it to penetrate any impervious caps over halo anomalies. Hydrogen in soils is usually sourced from gas reservoirs but this /signal is not definitive because this gas can be produced as well by biodegradation and redox reactions.

The second outstanding feature of the survey was the discovery of a major anomaly estimated to be 477 acres in size consisting of light oil with associated condensates and rich gas at the south end of Area B. It was detected using contoured maps of C1/C2 and hydrogen. CO2 contour data, which showed a major halo anomaly at this location, explained the low values of C2+ and methane anomalies in this area. The carbonate cap of the halo anomaly provided a barrier for upward migration of hydrocarbons. Another light oil anomaly of 72 acres was discovered on a major NW-trending fairway of condensate and rich gas that is considered to be very prospective**.** Two anomalies of thermogenic dry gas of 67 and 176 acres open to the north were found at the northern border.

In Area A, three groups of oil and gas prospects based on C1/C2 anomalies were found. Hydrocarbons are ubiquitous in this area where, based on C1/C2 contours, anomalous areas of heavy and light oil comprise 1232 acres, condensate 3119 acres and rich gas 819 acres. Of the 16 anomalies found seven are light oil, four heavy oil, four rich oil and one condensate.

Enough data has been developed to warrant drilling of the unique Helium Prospect #1 associated with nitrogen in Area B. At the 5.5 ppm helium level this prospect is 421 acres in size and is open to the north, west and south. Seismic should be considered before drilling to confirm the existence of a structural trap deemed to be in the Entrada Formation. Given favourable drilling results geochemical soil gas sampling on a 200 meter high-density spacing is recommended to extend the anomaly in three directions. Options on adjoining leases should be acquired before drilling. Information on the drilling results should be closely held in any case.

A sampling program should focus on defining and extending beyond the current survey borders the two highly prospective light oil and associated gas prospects in Area B. Estimates based on hydrogen concentration data place the size of the two prospects from this survey at 1268 and 218 acres.

A sampling program is recommended comprising infill on 200 meter spacing and reconnaissance on 400 meter spacing to extend the discovered helium and petroleum anomalies beyond the current survey borders. Particular focus should be placed on connecting Areas A and B.

It is recommended that in future geochemical soil gas and seismic surveys the anomalies of helium, heavy oil, and light oil (and associated gases) be correlated with trends in fault/fracture systems. It is well established that fault/fracture sets have been the conduits for charging of both helium and oil reservoirs. The establishment of fairways for each of the targets will increase chances for discovery as well as enhance the potential for helium reservoir development by a clearer understanding of drainage patterns.

The potential for discovery of commercial reservoirs of helium and hydrocarbons in Cisco Springs is large but this can only be achieved with good planning that includes timely and appropriate use of seismic, geochemical soil gas surveys, big rig drilling and acquisition of contiguous leases.

2. Introduction

Paul Lafleur, President of Petro-Find Geochem Ltd, was first contacted by email on October 2, 2019 by Steven Tedesco, Owner of Running Foxes Petroleum, regarding the possibility of a geochemical helium/hydrocarbon survey in the Cisco area in Utah, about 50 miles west of Grand Junction, Colorado. He mentioned that he had two partners from Germany. Tedesco provided a map outlining the three areas to be surveyed.

On November 12 Tedesco suggested that the survey might be conducted after our Four Corners helium survey in late November and early December to save on time and expenses for mobilization and demobilization. However, it was agreed that it would be better to conduct the survey early in 2020. On February 21, 2020 a contract was signed for a geochemical soil gas survey consisting of 324 points; analytes would be helium/hydrogen/neon, light alkanes/alkenes and CO_2. The geochemical soil gas survey was conducted in the March 08-16 period by Paul Lafleur and Rudy Willick, General Manager, Petro-Find Geochem Ltd.

All soil gas analysis for helium/hydrogen, light alkanes/alkenes and CO_2 was performed in Petro-Find's laboratory in Saskatoon, SK by Rudy Willick, graduate chemist.

The helium/hydrogen/neon and hydrocarbon/CO2 data was provided on April 7 and 10, respectively. Based on this data, Tedesco provided on April 15 a "Discussion of Soil Gas Data Survey"

The objective of the helium/HC survey was two-fold: (1) Define potential areas of helium accumulation; and (2) define areas of petroleum accumulation for further field development.

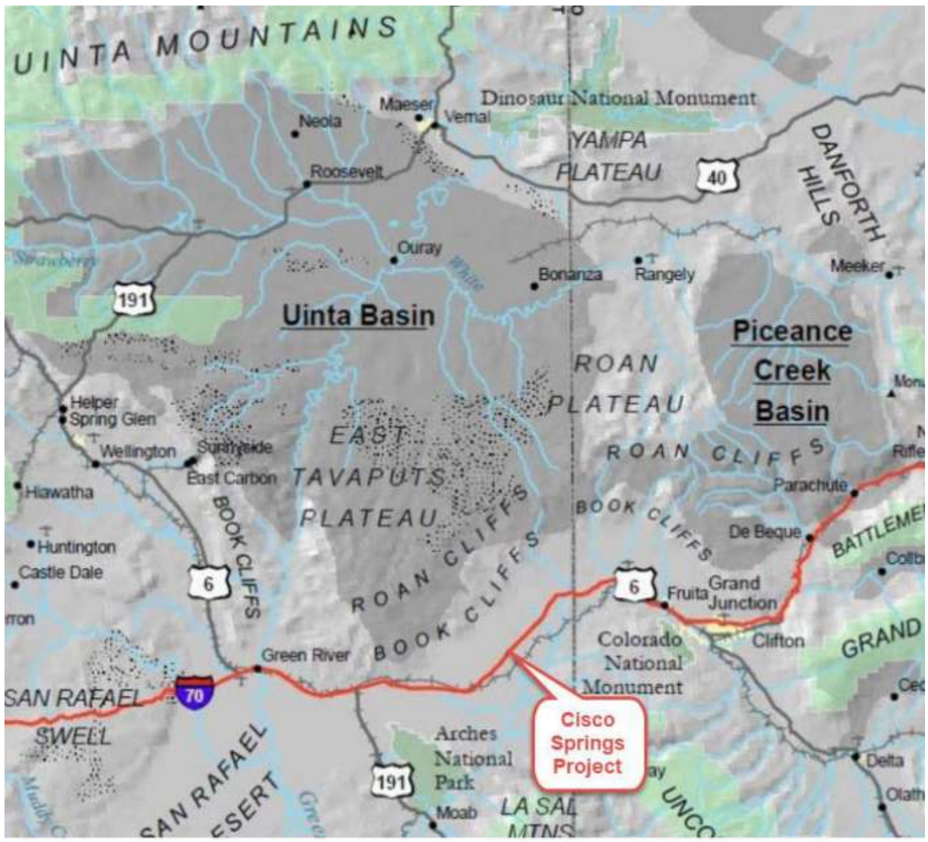


Figure 1. Location of Cisco Springs Project

3. Property Location, Accessibility and Topography

The Cisco Springs geochemical soil gas survey in Utah was located about 60 miles west of Grand Junction, Colorado along I-70 (Figure 1). The project consisting of three areas - SW (Area A), NW (Area B) and NE (Area C) – was accessed from I-70 by the Danish Flat exit road (Figure 2).

A total of 324 preselected survey points were reached by truck across a featureless prairie (Figure 3), and points in less accessible areas by foot and ATV (Figures 4-7). Main roads –Cottonwood Rd and Cisco Springs Rd - have year round maintenance by the county and many roads accessing old well locations from these main roads still exist. Two washes on the west side of the survey, Danish and Cisco, dissect Areas A and B, respectively, requiring walking and ATV to access the survey points (Figures 6 and 7).

Probe drilling to a 2.5-foot depth was generally easy in the greyish Mancos shale over most of the area. Soil development was poor or non-existent with cactus and sagebrush predominating. Gravel beds and unconsolidated rubble made drilling more difficult in Cisco Wash northwest of Area B (Figure 5).

The Danish Flat wastewater treatment plant is described here because of its potential to contaminate surface soils from hydrocarbons in evaporation plumes. In place since 2008 it treats produced water trucked in from oil and gas operations using evaporation ponds and other processes to extract useful compounds from the water mixture (Figures 8 and 9).

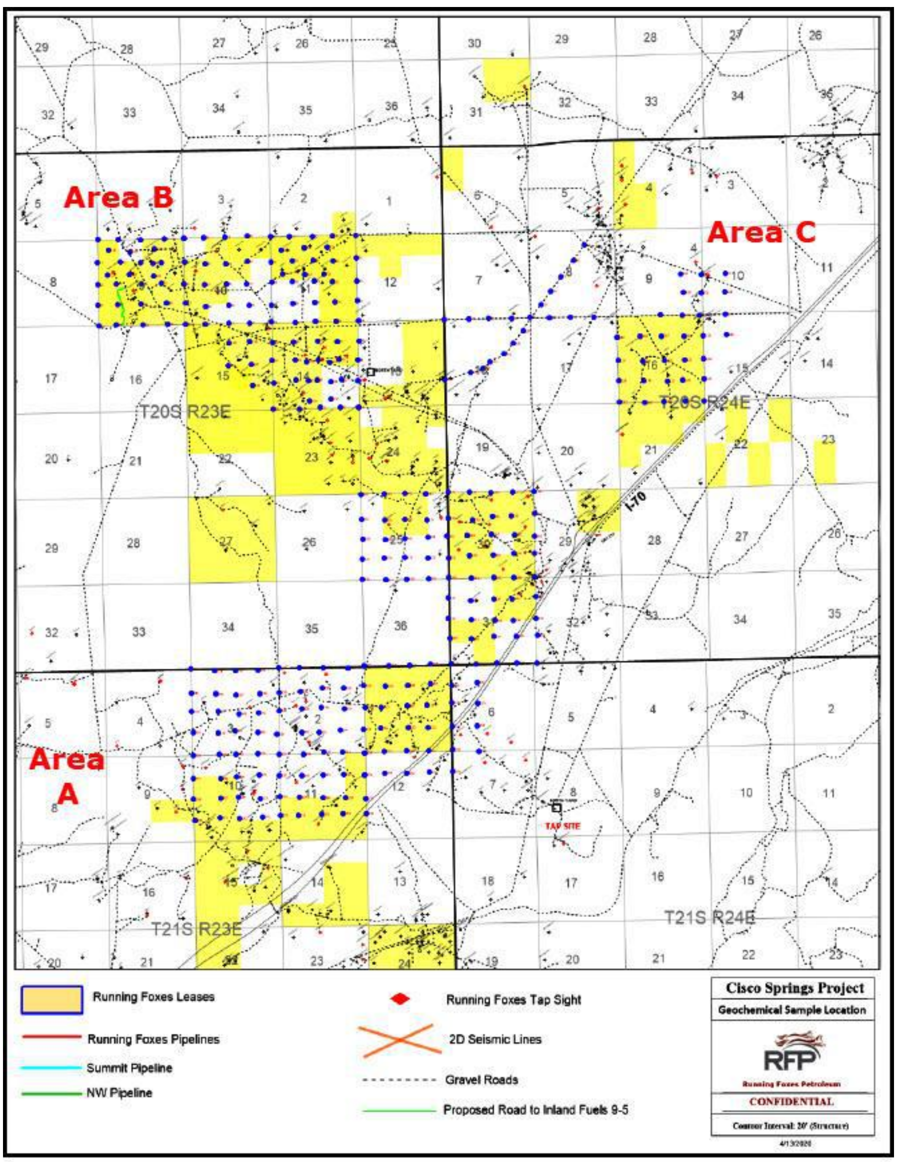


Figure 2. Geochemical Survey - Running Foxes Petroleum Leases (Source: Tedesco)

Figure 3. Featureless Plain

Figure 4. NW corner of Area B

Figure 5. X-Section soil profile Cisco Wash Area B

Figure 6. Sampling on hill, Area A

Figure 7 . Draw Danish Wash Area A

Figure 8.Cisco Danish Flat waste water treatment facility

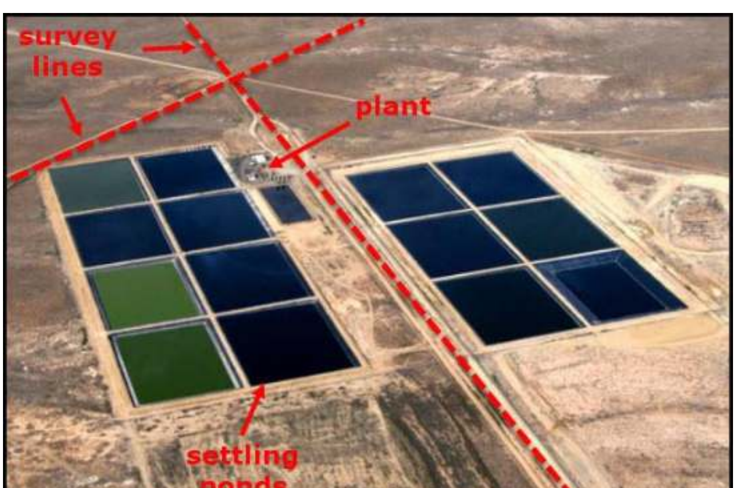


Figure 9. Aerial view Danish Flat water treatment plant
Source: The Salt Lake Tribune, Aug 28, 2014

4. Previous Exploration

Production of oil and gas in the Cisco Springs oil field area began in the 1950's from generally small isolated accumulations in relation to anticlinal closures, faulted structures and stratigraphic pinch-outs (Tedesco). Extensive infrastructure, mostly abandoned, such as horseheads, tanks, separation plants, plugged wells, and pipelines, are seen in most of the area (Figures 10-12). Stripper wells appear to be still operating. In 2009, approximately 17 miles of 2D were shot in order to better define seemingly very erratic reservoirs (Tedesco). (Figure 13).

The Cisco Springs oil field is part of the Greater Cisco oil field including Cisco Dome and Cisco Wash, which was discovered in 1924 in the now abandoned town of Cisco, Utah**.** (Figure 14). Helium in Harley Dome, some 13 miles to the NE from Cisco Springs, was discovered in 1925, but mainly because of low prices for helium and nitrogen being the associated gas, production commenced only recently. The Greater Cisco oil field has been developed intermittently since then with the discovery of several small accumulations of oil.

The Greater Cisco oil field including the Cisco Springs oil field is actually a series of localized oil accumulations that produce from several different channel sands in the Mancos, Cedar Mountain, Dakota, Saltwash and Brushy Basin zones. Natural gas and oil is produced from the Mancos, Cedar Mountain and Dakota formations, while the Brushy Basin and Saltwash production is mostly crude oil. The oil gravity is reported to be 34–35 degree API while the natural gas is 1,100 BTU (1,200 kJ). The oil in these reservoirs is typically a moderate to light green color. However, the oil found in the Saltwash and Brushy Basin reservoirs contain a heavier black oil, reportedly Pennsylvanian in age, that has migrated from the adjacent Paradox Basin.

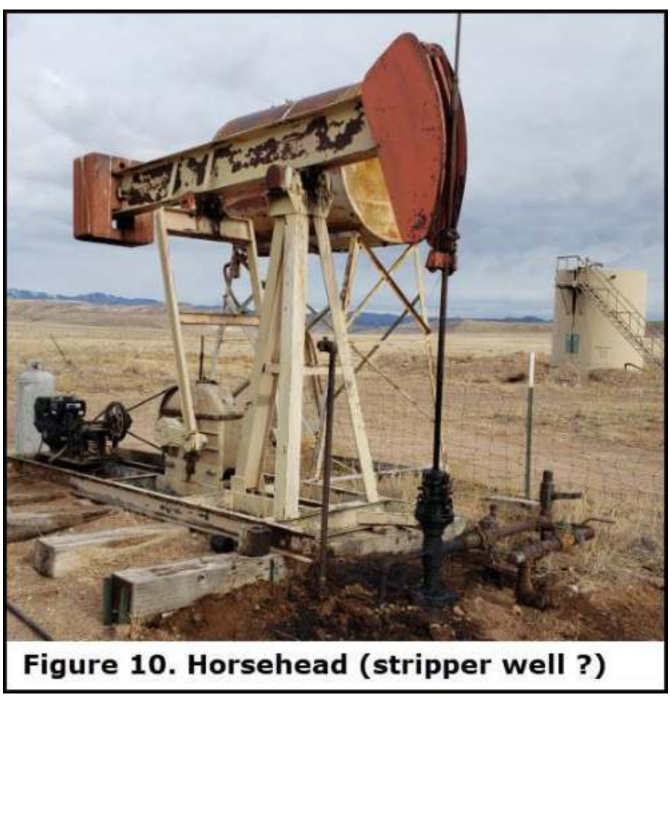


Figure 10. Horsehead (stripper well ?)

Figure 11. Wellhead abandoned

Figure 12. Old well head

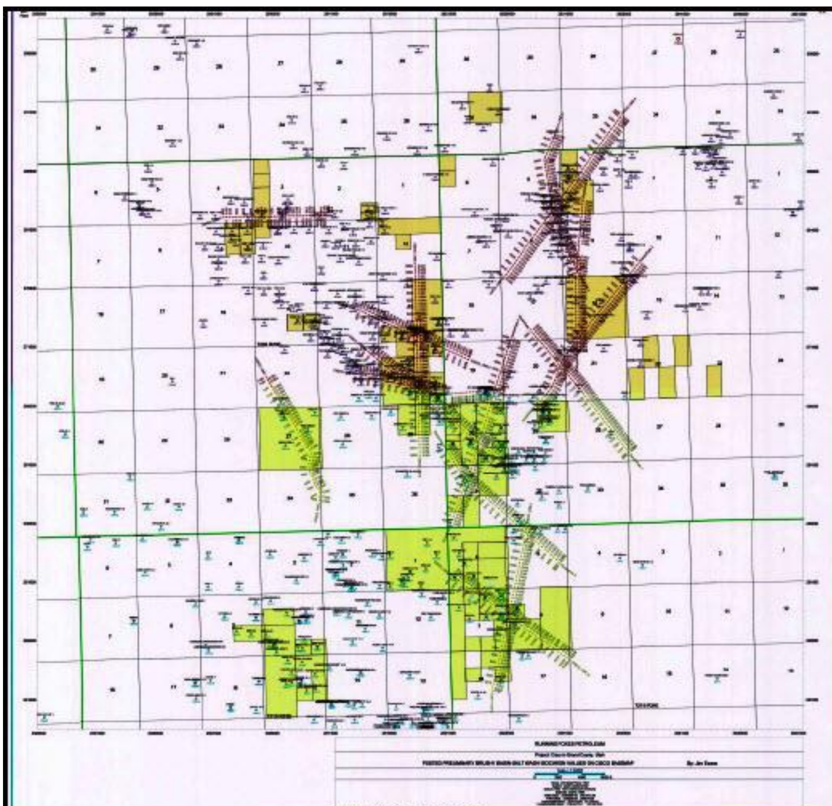


Figure 13. Seismic lines
Source:Tedesco

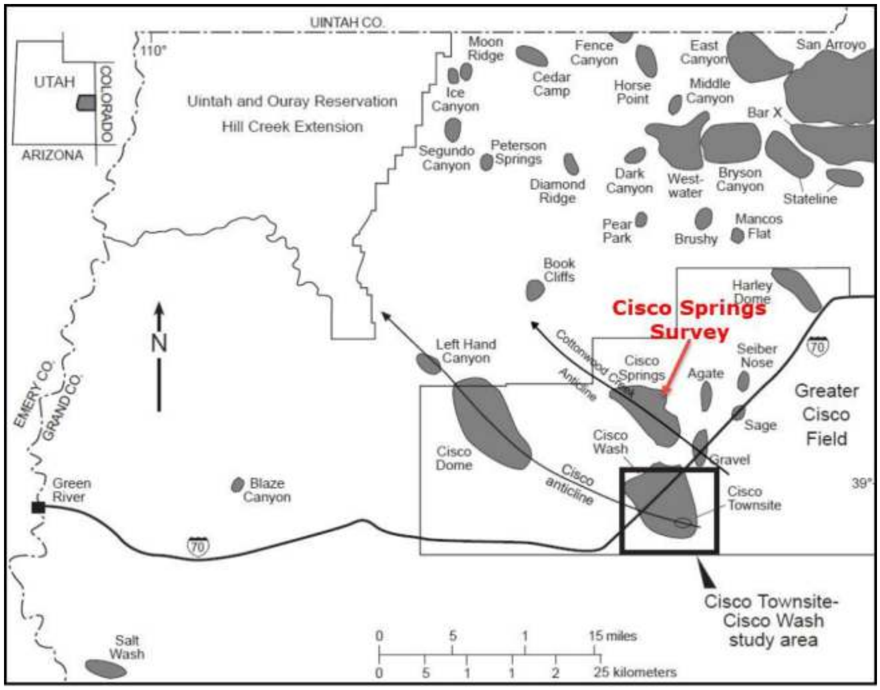


Figure 14. Greater Cisco Field including Harley Dome (Source: Tedesco)

5. Geology

This section describes the structure, stratigraphy and petroleum systems of the Cisco Springs area.

Structural

The Cisco Springs geochemical survey was conducted on the northwest extension of the Uncompahgre Uplift of the Colorado Plateau. This uplift underlies the Uintah Basin in the Northwest in Utah (Figures 15 and 16) and extends SE 60 miles to the San Juan Mountains in SW Colorado. The Uncompahgre Uplift creates a boundary between the Paradox, Uintah and Piceance Basins (Figures 1, 14).

The Colorado Plateau, a large (500,000 km2); structurally intact, high elevation, tectonically enigmatic province that makes up a large part of the North American southwest (Annex 2), is bounded by the Rocky Mountains in Colorado and Wyoming to the east and north, the Basin & Range in Utah and Nevada to the west, and the Mogollon Rim in Arizona and Rio Grande Rift in New Mexico to the south.

The Uncompahgre Uplift is eroded by the Colorado River at Cisco Springs to reveal the Upper Cretaceous Mancos shale in the Cisco Springs project area (Figure 17) and the disappearance of the Mesaverde, Green River and Wasatch formations of the Cenozoic. The Uncompahgre Uplift is an anticlinorium, a large anticline on which minor folds have been superimposed (Figure 18). Cotton Creek and Cisco Anticlines provide structural traps for the oil fields in the Greater Cisco field area including the Cisco Spring oil field.

According to Tedesco (Abstract: Geology and Seismic Interpretation of the Cisco Springs Area, Uncompahgre Uplift, Grand County, Utah; AAPG Search and Discovery Article #90169; 2013) “Oil production from the Cisco Spring is predominantly from the

Cretaceous Dakota and Cedar Mountain sandstones that were deposited in a general northeast-southwest direction. The area is dominated by the plunging northwest trending Cottonwood Creek anticline that is faulted on its southwestern side. Associated with this structure are numerous isolated single well producers, both structural, structural-stratigraphic and stratigraphic traps that are in many cases surrounded by numerous dry holes. The top of the structure is dominated by sub-economic to marginally economic gas wells and a series of oil wells in a graben structure that parallels the structural high to the west. Numerous cross-faulting and compartments help to define the present productive trend and potential additional locations. Some of these wells have produced over 40,000 barrels of oil and simple volumetric calculations suggest many of these wells are draining a much larger area. (Figure 19)

Also according to Tedesco "In 2009, approximately 17 miles of 2D were shot in order to better define the seemingly very erratic reservoirs. Seismic interpretation confirmed that a number of channels on and off structure are narrow elongated channels that would be difficult to find using subsurface mapping methods alone. The integration of seismic with subsurface data has revitalized an old area."(Figure 13)

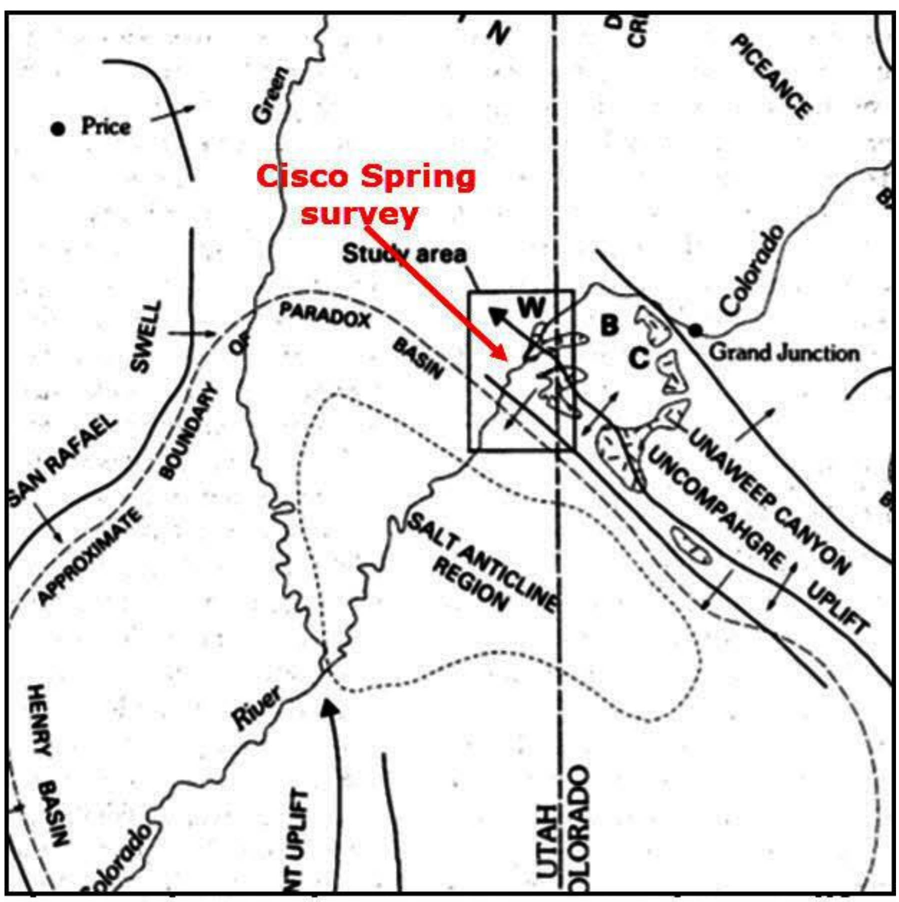


Figure 15. Cisco Spring Survey in Relation to Uncompahgre Uplift (Source: Case)

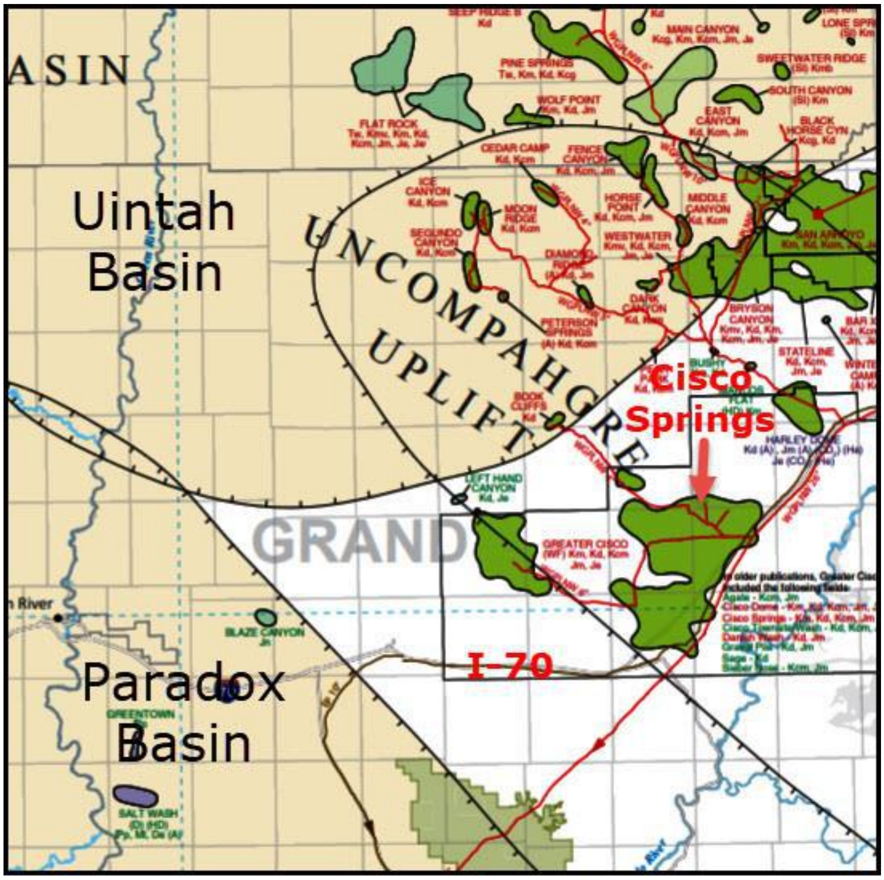


Figure 16. Cisco Springs Uncompahgre Uplif Source: Utah Geological Survey map

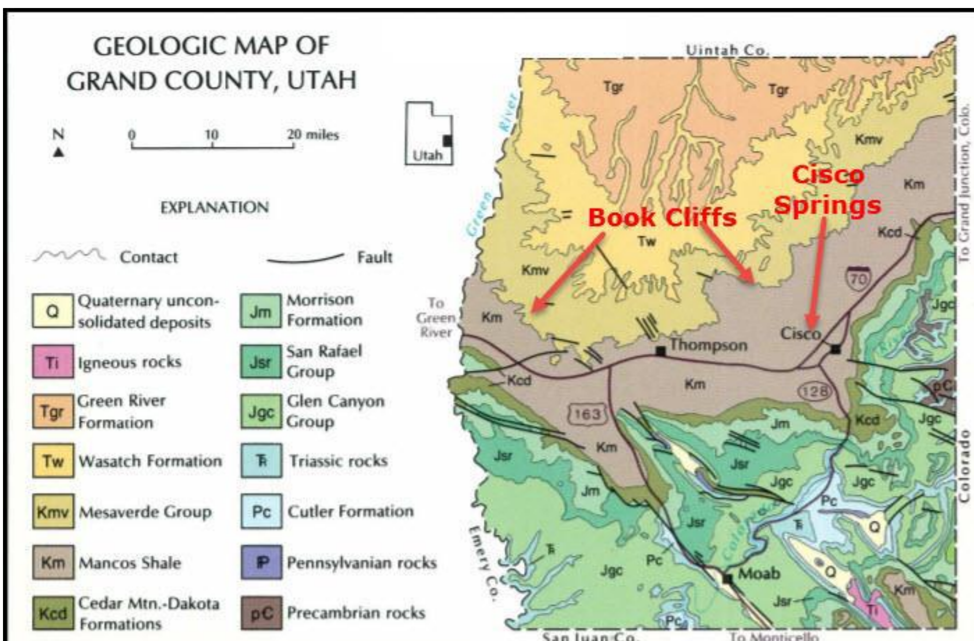


Figure 17. Geological Map Grand County, Utah (Source: Utah Geological Survey)

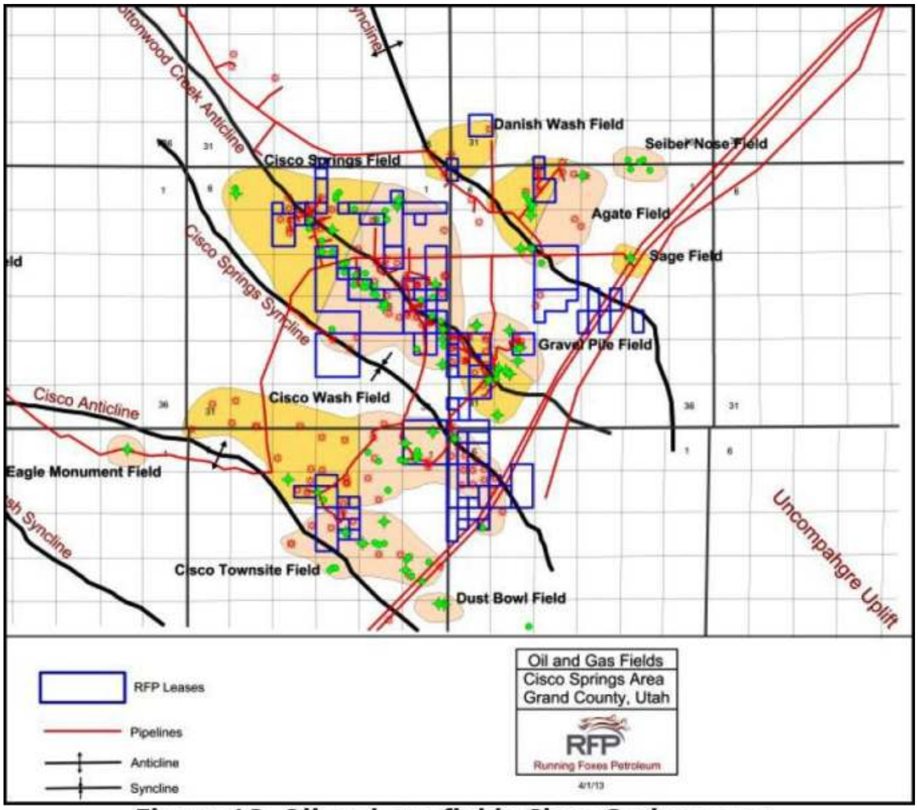


Figure 18. Oil and gas fields Cisco Springs area
Source: Tedesco

Stratigraphy

The stratigraphic column depicted in Figure 20 shows deposition of continental clastic and shales from the Triassic to Upper Cretaceous. Noticeably absent are marine sediments like limestones and dolomites that host helium deposits in the Paradox Basin to the west and south. Not depicted in the stratigraphic column are the Upper Cretaceous Mesaverde, and the Eocene Green River and Wasatch Formations that have been eroded away in the immediate are of Cisco Springs (Figure 17).The Upper Cretaceous Mesaverde Formation are cliff-forming gray-brown layered sandstones that make up the Book Cliffs just to the north of Cisco Springs (Figure 4). The green River Formation is composed of thin carbonaceous laminated shale deposited in a lake environment. The dominant lithology of the Wasatch formation is red-brown shale and fine-grained sandstones.

The oil and gas producing strata comprise the Cretaceous Dakota and Cedar Mountain Formations, and the Brushy Basin and Salt Wash members of the Morrison formation. These formations outcrop just east of the project area across I-70 highway. The x-bedded sandstone Entrada Formation just below the Morrison formation, does not appear to host hydrocarbons in this area. However, it is the host strata for helium in the Harley Dome some 13 miles to the NE along Highway I-70. The fact that the helium is associated with nitrogen rather than hydrocarbons may indicate a lateral migration of mantle volatiles from the Colorado Plateau margin (Figure 23)

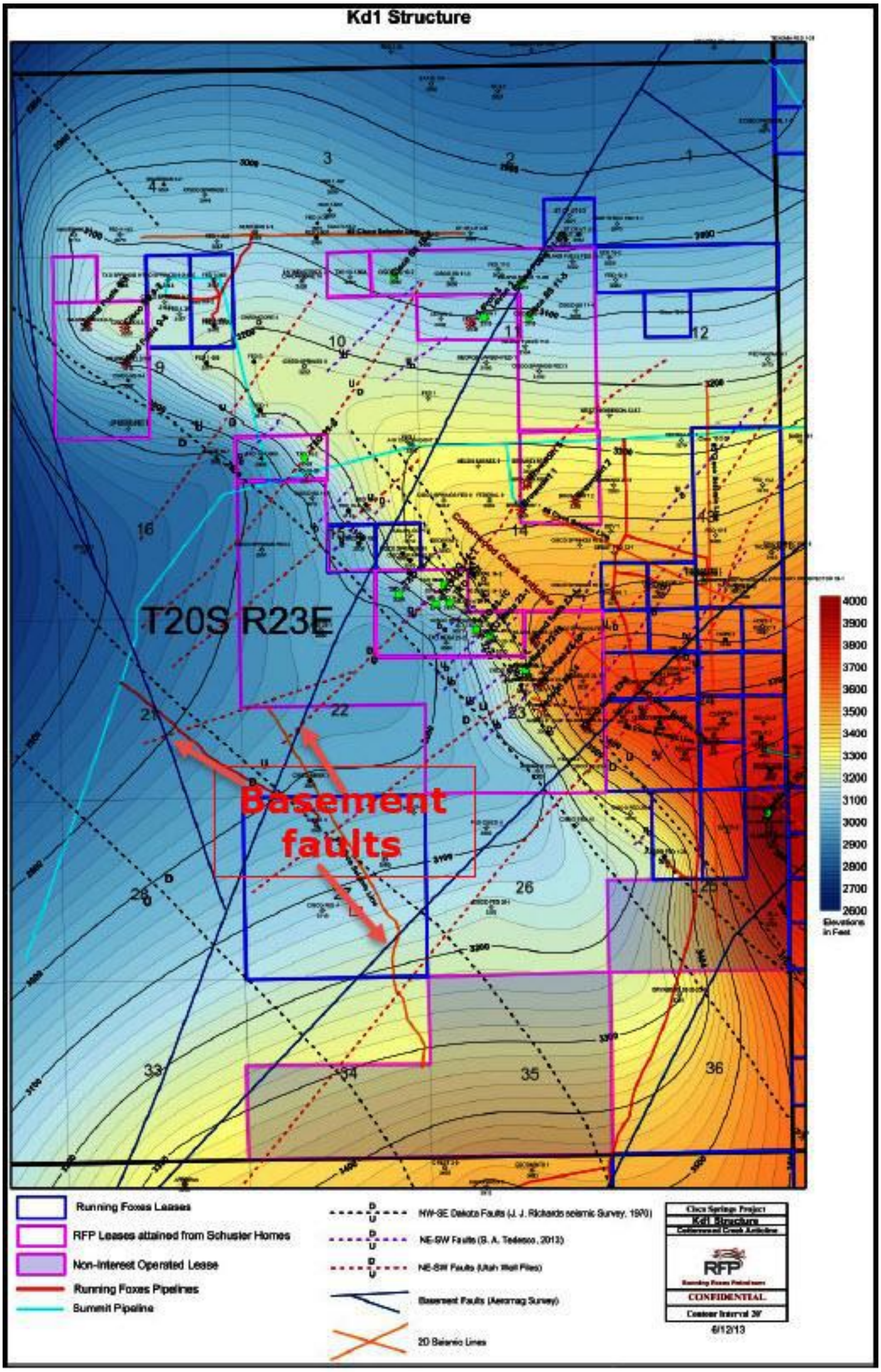


Figure 19. Dakota formation structure

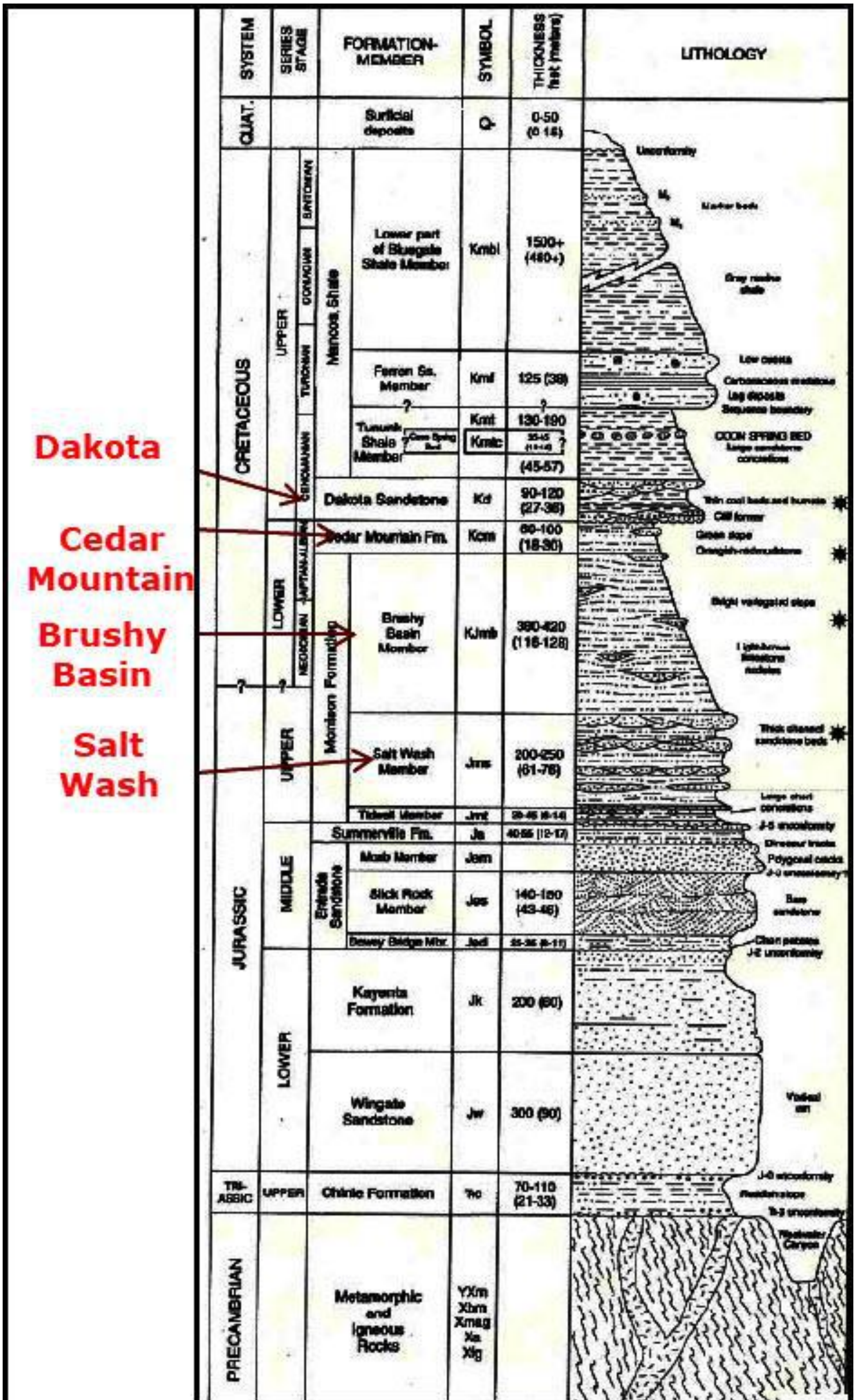


Figure 20. Stratigraphy of Cisco Springs area (Source: Tedesco)

Petroleum Systems

Three petroleum systems are indicated using plots of methane/ethane and methane/pentane: one with a heavy oil signature, another with a light oil/condensate/rich gas signature (Figures 35 and 35A), and a dry gas with a methane signature. The methane/ethane ratio is used extensively in this report to determine gas and oil prone areas and prospective reservoirs in Area A, but not as much in Areas B and C because of heavy biodegradation of ethane in the samples. Ethane is absent in 24 % of samples in Area A, 54% in Area B and 83% in Area C.

The heavy dark oil is Pennsylvanian, probably sourced from the Phosphoria formation and perhaps the Hermosa formation; the light oil is sourced from the Dakota Formation (communication with Tedesco). The source rock for the dry gas, previously undiscovered, is unknown. A paper by Lillis - "Petroleum Systems of the Uintah and Piceance Basins..."- describes 3 petroleum systems depending on source rock (Figure 20A). The report goes on to say that the main source rock for the hydrocarbons at Cisco Springs is the Phosphoria formation which extends further south than originally thought (Lillis).

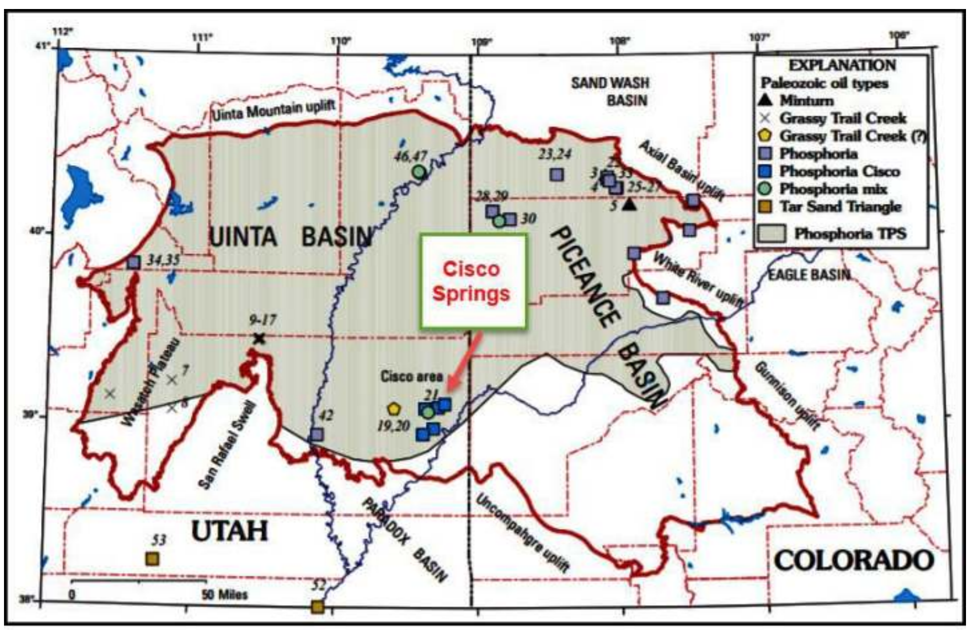


Figure 20A. Paleozoic oil sample locations of the Uinta-Piceance Province (Lillis)

6. Helium Exploration Principles

Exploration principles are discussed below under the following headings: Past Practices; Current practices by industry in the exploration for helium in the Phanerozoic; New Developments; and New Approaches.

Past Practices

Almost all of the helium discovered worldwide has been found by chance in the drilling for hydrocarbons. Targets were usually anticlinal structures found by seismic surveys.

The association of helium and natural gas in reservoirs is purely coincidental because the source rocks for each are different - natural gas is mainly produced from diagenesis of carbon rich shale. Helium in Phanerozoic reservoirs in the Cisco Springs area is associated mostly with hydrocarbons (Source: Tedesco), but in the Harley Dome nitrogen is the associated gas. The association of helium and nitrogen is genetic i.e. arising from a common origin (see discussion below). Undoubtedly, more helium reservoirs will be discovered this way, especially with the advent of the use of mass spectrometry in the analysis of natural gas/nitrogen/CO2 streams.

Geochemical helium surveys in Phanerozoic exploration were underused and even ignored in exploration. Industry attempts to use helium as a pathfinder have been mostly unsuccessful because of poor sampling equipment and methods; too large a sample; inability to sample wet sediments; leakage problems with long-distance transport in containers or vials from field to laboratory; and inappropriate analyzers for helium. While the major difficulty in measuring helium in soils is its volatility, its inertness is a plus factor. Fast sampling methods and extraction of too large a sample can lead to the exhaustion of soil gas at the tip of the probe thus causing dilution of the sample with ambient air drawn down from around the annulus of the probe. Ideally, sampling depth in loose soils should be at least three feet to avoid the pumping action of ambient air pressure; it is less for tight clays.

Using the uranium exploration model, helium produced by the decay of uranium/thorium (alpha particles plus pick-up of two electrons), migrates from the crystalline basement rocks to sedimentary strata where it is trapped by overlying shales and evaporites including salt, anhydrite and gypsum (Annex 3). However, some of the helium escapes through the cap rock and thence to the surface where it is trapped temporarily in the interstices of soils before it finally escapes to ambient air. It is well known that fractures/faults and bedding planes provide comparatively faster flow paths for helium to reach the surface. The helium concentration in ambient air at 5.4 ppm has held steady for many years.

Current Practices

Current exploration for helium in Phanerozoic strata basically uses the uranium exploration model as a guide (Annex 3). A new geochemical exploration system for helium in the Phanerozoic is considered highly desirable by industry because conventional exploration using geophysics and drilling is highly inefficient, environmentally unfriendly, costly and time-consuming.

However, according to McDowell most petroleum explorationists are not familiar with helium exploration. The current exploration system in the Phanerozoic uses a modified petroleum system concept that has been used successfully for decades to high-grade plays and de-risk oil and gas prospects. Like a petroleum system the helium system is identified by its source rock, reservoir, trap, seal and migration pathways. The helium gas as well as nitrogen and CO2 are believed to migrate through basinal brines systems until trapped (Figure 21). Helium can come from a variety of sources: Helium- 4 is derived from the decay of uranium/thorium in the crust while Helium-3 is primordial having been left over from the time of earth's formation. Nitrogen, which is usually associated with helium, is also thought to be sourced from basement rocks due to their

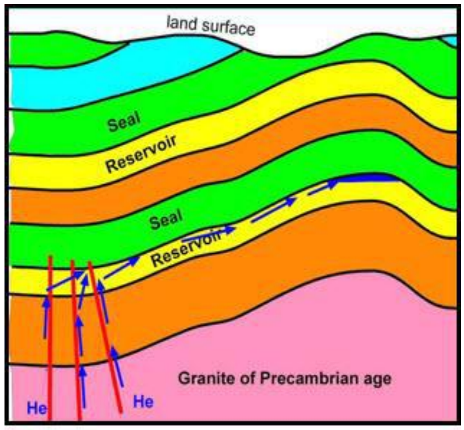


Figure 21.Helium migration from basement

Helium Exploration – Some Principles

- **Economic helium is found in reservoirs associated with nitrogen, CO2 or hydrocarbons**
- **Helium is derived from the radioactive decay of uranium and thorium in basement rocks and old siliclastic sediments such as fractured shales, arkoses and granite washes; helium diffuses into pore water**
- **Theory: generation/accumulation of helium in pore water followed by interaction of pore water with a gas such as nitrogen and CO2**
- **Generation time needed to form high helium gases is millions of years and thus likely to be associated with old pore water and not necessarily with age of rocks**
- **Once helium is entrained in a gas, it migrates with the gas just like other gas accumulations**
- **As in uranium exploration, helium can migrate vertically to the surface where it can be sampled and measured.**

Figure 22. Some helium exploration principles

high correlation with helium in certain areas. It is thought that the source of nitrogen may be related to the metamorphism of micas.

Helium exploration in the Phanerozoic adheres to certain principles (Figure 22). For substantial helium gas to develop, three important geological events must be present: production of helium from the decay of uranium in crystalline basement rocks or in black shales; adequate fractures and faults to allow helium to escape into the overlying Phanerozoic sedimentary rocks; and a cap rock tight enough to hold any helium in commercial quantities. In most cases helium is found in formations close to bedrock where helium is generated. However, as helium migrates continuously upward it can be found in commercial quantities in formations in the upper Phanerozoic if a suitable trap is found such as a petroleum gas reservoir.

New Developments in Helium Exploration

New evidence on the relationship of large quantities of helium over large areas to tectonically and magmatically active regions have refocussed exploration. This new approach was the result of a simple observation at Yellowstone National Park (and elsewhere): helium emission rates from Yellowstone exceed (by orders of magnitude) any conceivable rate of generation within the crust.

According to Yirka, the large amount of ancient helium that is constantly being released in Yellowstone is the result of a magma hot spot releasing previously trapped gases. Approximately two million years ago volcanic activity began in the area. But prior to that, the area was relatively quiet, for perhaps as long as a couple of billion years. During that time it appears that helium was building up in the crust (because of lack of groundwater or crust movement), but not so much to the point that it created enough pressure to push its way to the surface. That didn't happen until the area became volcanic - hot magma beneath the trapped helium pushed it upwards, eventually squeezing it through cracks, steam vents and geysers at the surface.

According to Yirka, a significant fraction of the earth's radioactive elements, particularly uranium and thorium, appear to be in the granitic rock of the upper continental crust. Uranium and thorium tend to be localized in the granites inside special minerals such as **zircon** (zirconium silicate, $ZrSiO_4$) and monazite. Atoms of radioactive zircon crystals often become embedded in larger crystals, such as mica, as magma cools and solidifies. It is contended that the Yellowstone example of intense crustal metamorphism causing massive efflux of helium is an analog of the Cisco Springs area where helium is reportedly ubiquitous in the Phanerozoic.

A 120-mile east-west x-section heat flow diagram across Eastern Utah depicts non-hydrocarbon migration such as helium, CO2 and nitrogen in the subsurface due to mantle degassing and crustal radiogenic processes (Figures 22A, 23). Precambrian suture zones as possible migration pathways for helium and associated are indicated. "The upwelling mantle provides sufficient heat to the crust necessary to expel nitrogen from metamorphosed mica." (Wiseman). A statistical analysis of legacy gas composition measurements across the Colorado Plateau indicates the presence of at least three key gas associations with helium: hydrocarbons, CO2 and nitrogen.

Another important development was the recognition that a large number of helium fields are associated with Precambrian suture zones that are thought to provide pathways for helium micro seepage into the overlying Phanerozoic (Figures 22A, 23, 24 and 25). This view is supported by the observation that many of the key helium /nitrogen reservoirs are concentrated in the lower portion of the Phanerozoic sedimentary cover with key Precambrian structural features being key migration pathways.

However, a possible crustal source reservoir for N_2 in the Precambrian basement is less certain. Some possible sources are N_2-bearing compounds such as micas and feldspars, which are found in a variety of crustal rocks, may be volatilized during burial heating, diagenesis, and/or meta- morphism. It is the general view that a combination of carrier gases (i.e. nitrogen and CO2) and faults/fractures allow helium produced from uranium/thorium bearing minerals in the Precambrian to migrate into the Phanerozoic.

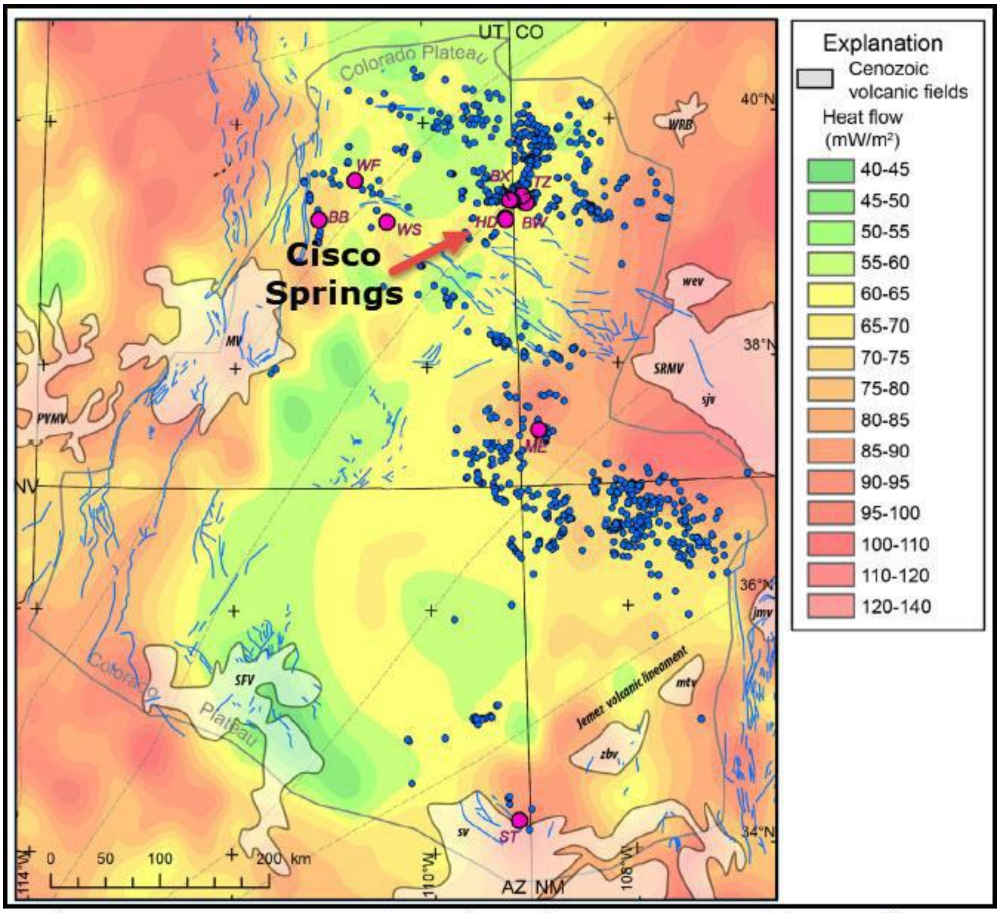
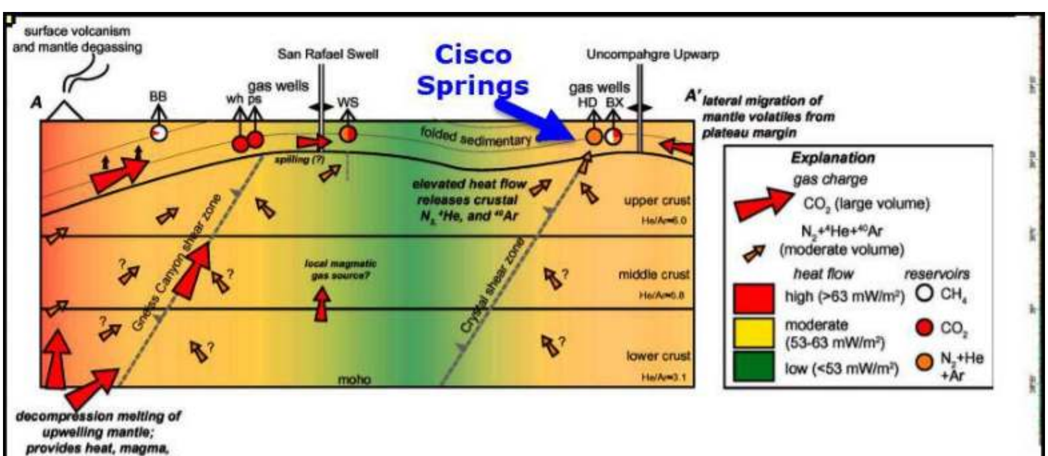


Figure 22 A. Map of regional patterns of heat flow and location of produced gas measurements Source:Craddock



East-west cross section (A-A') heat flow diagram spanning nearly 120 miles (~200 km) from Craddock and others (2017). Diagram depicts non-hydrocarbon gas migration in the subsurface due to mantle degassing and crustal radiogenic processes from the Wasatch line in central Utah to the Colorado state line. Cross section transects the Buzzards Bench (BB) field on the western, and the Woodside Dome (WS) field on the eastern, flank of the north plunging San Rafael Swell and continues through the northwest trending Uncompahgre uplift to intersect the Harley Dome (HD) and Bar X (BX) gas fields in east central Utah. Note Precambrian suture zones as possible migration pathways for helium and associated non-hydrocarbon gases. Along with mantle degassing processes, the upwelling mantle provides sufficient heat to the crust necessary to expel nitrogen from metamorphosed mica and radiogenic helium from heavier elements in the warm basement rocks where they are likely dissolved into and transported via groundwater interaction.

Figure 23. X-Section of heat flow diagram and migration of helium and other volatiles (Source: Wiseman)

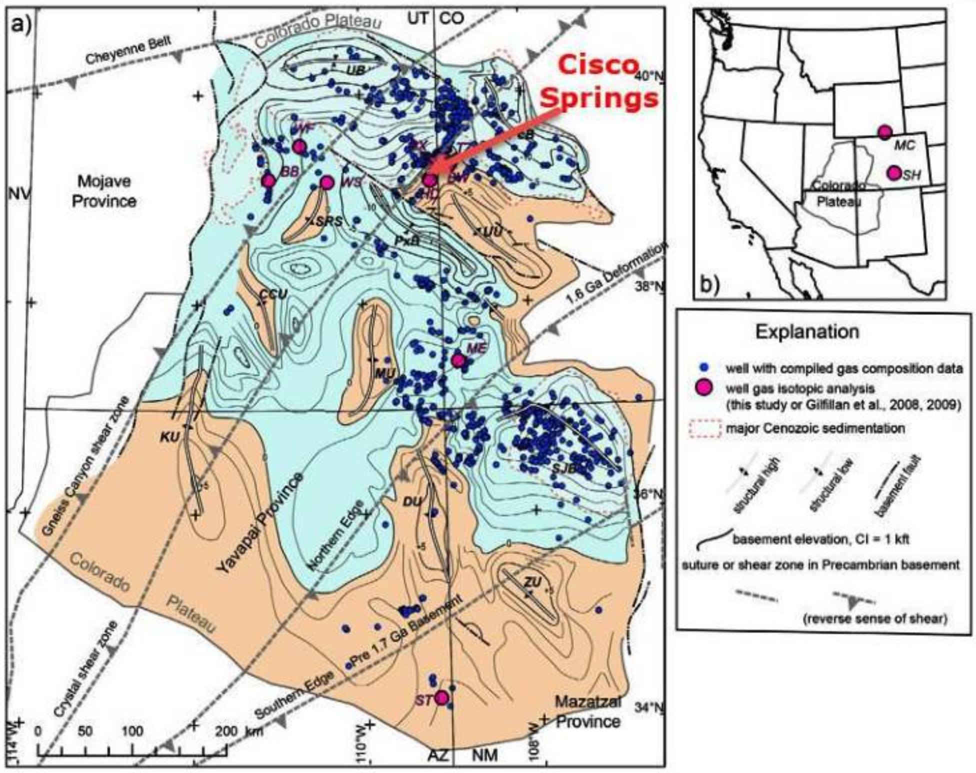
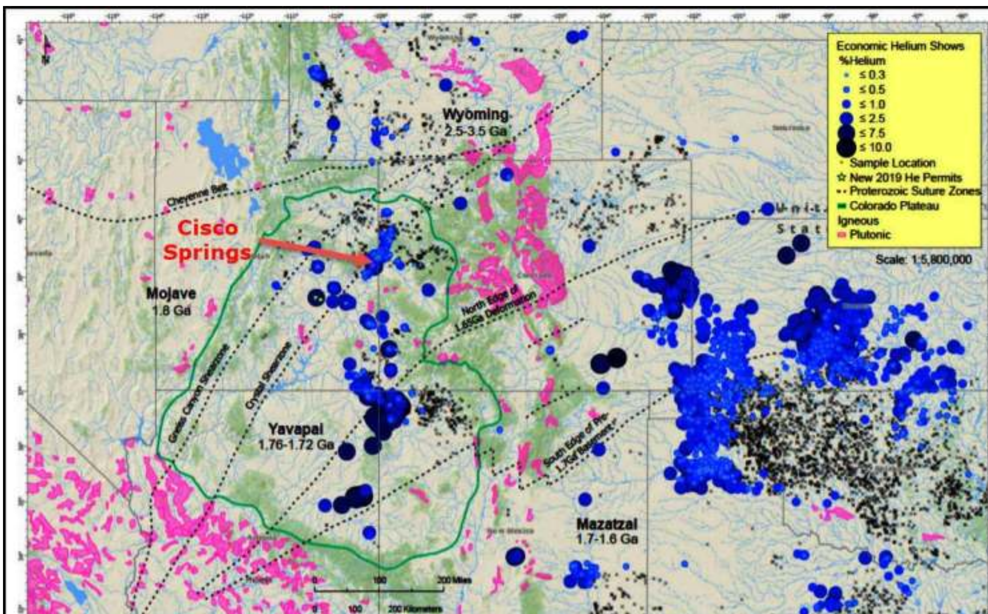


Figure 24. Map Showing Shear Zones in Basement. Source: Craddock



Graduated symbol map showing the major helium trends in the United States clustered near northeast trending Proterozoic accretionary boundaries. Note that the greatest density of helium analyses are from the gas stream of wells drilled in the depleting Hugoton-Panhandle gas field complex throughout Kansas, Oklahoma and Texas. Other significant helium analyses are shown clustered in the Four Corners region within the interior of the Colorado Plateau region. Colorado Plateau outline modified from Fenneman and Johnson (1946). Helium and igneous pluton data modified from U.S. Geological Survey (2015). Proterozoic suture zones modified from Karlstrom and Humphreys (1998).

Figure 25. Major helium trends clustered near NE Proterozoic accretionary boundaries Source: Wiseman

	C1/C2	CI/C3	CI/C4	*C1/(C1-C4)*	C2/C3
OIL	4-10	10-20	15-40	0.55-0.75	1.0-2.5
O/G, COND	10-20	20-50	40-100	0.75-0.95	2.5-4.0
GAS	20-50	50-100	100-200	0.95-1.00	4.0-6.0
BIOGENIC	>100	>100	>200	0.99-1.00	>>6.0
Gas Seep	146	3600	7100	0.99	23.5
Gas Seep	25	60	150	0.94	2.8
Gas Field	17	76	166	0.94	4.2
Cond. Field	11	40	115	0.91	3.8
Cond. Prosp.	13	34	92	0.89	2.7
Cond. Field	9.5	18.4	16	0.89	2.0
Oil Seep	5	16	52	0.80	2.4
Oil Field	6	10	20	0.75	2.0
Oil Field	6	10	9	0.71	1.7
Oil Field	4	8	7	0.66	1.7

Table 1 . Interpretive Guidelines Hydrocarbon Ratios Source: E & P Geo Field Services

7. Hydrocarbon Exploration Principles

Modern geochemical methods, such as Petro-Find soil gas surveys, are important tools for finding hydrocarbon reservoirs because they are direct indicators of hydrocarbons (**http://www.gasoilgeochem.com**). Light hydrocarbons naturally escape as microseeps from reservoirs and travel vertically to the surface where they can be sampled and analyzed by gas chromatograph. Concentration patterns or surface anomalies of these microseeps can be reliably related to hydrocarbon accumulations at depth. Open and closed fractures/faults in such surveys can be detected at the surface by linear patterns of unusually high or low concentrations in soils. The alkane/alkene ratio such as ethane/ethylene is also used to indicate normal faulting. However, it should be noted that apical methane anomalies can be modified by severe biodegradation which can reduce the size and shape of the anomalies. The halo type appears over reservoirs in certain hot and humid areas where very active aerobic microbes in near-surface soils attack the upwardly migrating hydrocarbons (Annex 6).

The fact that the relative amount of light alkanes in soil gas has about the same relative composition as the gas in the underlying reservoir provides a reliable indicator of the type of reservoir a hydrocarbon anomaly represents. In general, the near-surface anomaly or surface expression of a hydrocarbon reservoir decreases in intensity once the reservoir undergoes production because of declines in pressure (Annex 4). These pressures are renewed after either water or CO_2 flooding but the surface patterns may be different.

The concentrations of methane (C1), ethane (C2), propane (C3) and butane (C4) as well as percent methane of total hydrocarbons and three ratios make up the basics for reservoir content predictions. Pentane is a useful indicator of condensate. In general, the reservoir content may be inferred from Table 1.

Rarely are all the four oil or gas indicators present in any one soil gas sample or area. As an oil reservoir is not homogeneous, ethane+ (i.e. total C2 to C4 Alkanes and C2 to C4 Alkenes) in soil gas is usually a better measurement of the hydrocarbon potential than the light alkanes individually. Anomalous ethane+ can indicate oil, condensate or natural gas reservoirs so certain ratios and percentage methane are used to differentiate between them. For example, oil is indicated if the methane/ethane ratio is in the 2-10 range, condensate in the 10-20 range and natural gas above 20. Methane is a universal component of oil, condensates and natural gas as well as the only component of biogenic gas.

Another useful ratio is methane divided by total light hydrocarbons. Oil is indicated if the proportion of methane to total light hydrocarbon concentrations is in the 45-75 % range, condensate in the 75-90% range and natural gas in the 90-99% range (C1/(C1 to C4, Table 1). In the exploration for natural gas, biogenic gas is ruled out if ethane+ is present. Isotope analysis of carbon and hydrogen in methane is used to differentiate between biogenic and thermogenic dry gas or gas that does not have C2+.

It is sometimes impossible to determine exactly the background value of geochemical soil gas surveys, especially if there is heavy biodegradation and source rocks are still expelling hydrocarbons. To estimate whether a source rock still contributes hydrocarbons depends on the type of source rock, relic effective or spent. If it is of the relic effective type, it is possible that it is continuing to expel hydrocarbons notwithstanding a thermal cooling event such as uplift and erosion. However, according to past exploration experience the contribution to surface signal is usually less than one ppm.

It should be noted that with the beginning of production, apical anomalies will change depending on the type of drive revealing doughnut or halo types of anomalies surrounding producing wells (Annex 6). Before drilling, light hydrocarbons (as well as helium) migrate vertically in the direction of lower pressure to the surface where they form anomalous patterns. However, once a well begins to produce, the light hydrocarbons are short-circuited horizontally to the well bore or area of lower pressure, thus modifying the original apical anomaly.

Reservoirs of natural gas (and oil) exhibit three types of geochemical soil gas anomalies – apical, halo and modified apical. An apical anomaly exists over the reservoir where light hydrocarbons migrate from the reservoir vertically to surface soils. However, apical anomalies may be modified by severe biodegradation which can reduce the size and shape of the anomalies. The halo type appears over reservoirs in certain hot and humid areas where very active aerobic microbes in near-surface soils attack the upwardly migrating hydrocarbons. A typical doughnut shaped anomaly with low methane values in the middle directly over the reservoir with discontinuous high methane concentrations in the periphery (Annex 6).

It is generally accepted that carbon dioxide produced from the biodegraded hydrocarbons reacts with water to produce carbonic acid which in turn reacts with calcium compounds to produce a calcium carbonate barrier. The calcium carbonate (calcite) can occur in soil profiles as caliche in desert environments or as marl in others. The near-surface calcium carbonate can act as a barrier to the upward migration of hydrocarbons except at the edges of the cap where high anomalous methane values can exist. Thus it is important to recognize whether the anomalous patterns are apical, halo or modified apical before undertaking any follow-up seismic or drilling programs. Misinterpretation has led to many dry holes drilled in the high methane anomalous periphery of the halo type.

8. Exploration Potential for Helium and Hydrocarbons in Cisco Springs Area

The new developments discussed above – hot spots and Precambrian suture lineaments – as well as known occurrences of helium detected previously are favourable factors in the exploration for helium in the Cisco Springs area. Anomalies of helium without any associated hydrocarbons would indicate helium reservoirs may exist at deeper depths. Helium in commercial quantities elsewhere is usually found close to the Precambrian. It is possible that the helium found in lower concentrations in the Cretaceous and Upper Jurassic (Salt Wash member) of the Cisco Springs area may represent leakage from the Middle Jurassic (Entrada Formation) which contains helium associated with nitrogen elsewhere. Detection of such helium anomalies over deeper reservoirs would be difficult without geochemical soil gas surveys. It should be noted that the main source rocks of Cisco Springs, the Phosphoria Formation, is known to be associated with uranium, a source of helium.

Past production of oil and gas since the 1950's shows the area is both oil and gas prone. Favourable source and host rocks with suitable seals as well as numerous fault systems increase the chance for discovery of bypassed reservoirs. Any depletion of natural gas from previous production as well as leakage from numerous well heads and plugged dry holes would negatively affect accumulation both helium and hydrocarbons.

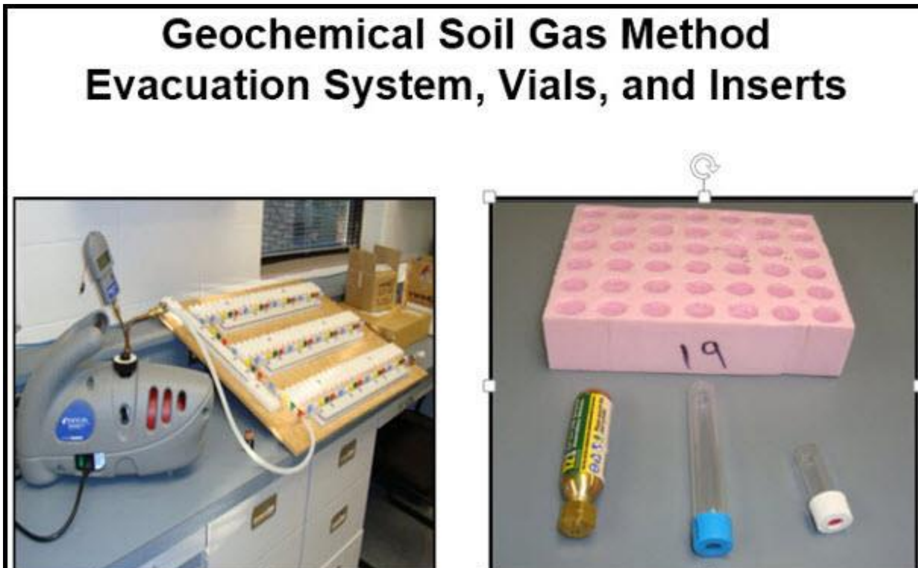


Figure26. Evacuation System and Vials

9. Methodology

The sampling program consisting of 323 sample points was conducted on a grid basis at three locations, A, B and C. All predetermined grid locations were sampled but some points required minor offsetting because they fell in inappropriate places such as cliffs and thorny bush areas. Sampling was conducted by truck over flat areas, and by walking and ATV over more rugged areas.

Location of sample points by Google on cellphones worked well because of a good Internet signal as did the traditional GPS method based on satellite connection. After sampling at the predetermined grid locations, the final coordinates were recorded by GPS.

The geochemical survey program began in Saskatoon with the preparation of sample vials in Saskatoon and the replacement of the probe septa (Figure 26). The vials were evacuated down to 1/5 Torr so that a sample extracted by a syringe was not contaminated with residual ambient air. To avoid breakage in transit the glass vials were inserted into holes cut into Styrofoam and placed in firm boxes for transit to Petro-Find's laboratory in Saskatoon. The evacuation system and probes are of Petro-Find's own design.

A cordless rotary drill was used to drive a hollow probe of stainless steel to an average depth of about two feet to avoid barometric pumping which can affect helium concentrations in soil (Figure 27). In the event water was encountered, the inner volume of the probe was reduced from 26 to 12 cc by inserting a stainless steel rod. This allowed the purging of less volume and less chance to pull surface water as well as ambient air into the syringe. Once the probe was purged of ambient air a 30cc sample was extracted and injected through the septum of a 12cc vial thus achieving almost a tripling of the pressure in the vial (Figures 28 and 29). Other operations at the sampling site are the recording of coordinates by GPS and recording of sample numbers on the box cover (Figure 30).

Figure 27. Drilling with probe

Figure 28. Taking sample with syringe

Figure 29. Injection of sample into vial

Figure 30. Recording sample number on box

GC with auto sampler for HC and CO2 analysis

Micro-GC for Helium/Hydrogen Analysis

Figure 31. Analytical Systems

The samples were shipped to Petro-Find's lab in Saskatoon for analysis by a state-of-the-art micro-GC for helium, hydrogen and neon as well as a gas chromatograph equipped with an auto sampler for hydrocarbons and CO2. Samples were hand-fed with each analysis taking about 7-10 minutes for the micro-GC. Output for the GC with autos sampler was 100 samples per day including duplicates.

Two types of maps were produced: bubble and contouring. Bubble maps were produced for all points; contour maps were made for individual areas (A, B and C) because the areas were to far apart to be contoured as a whole like bubble maps. Bubble maps are most useful to identify anomalous trends but contour maps are most useful in defining the relationships between anomalous points as well as indicating anomalous areas extending onto adjoining properties.

For bubble maps the coordinates and analytical data were saved as a ***dat*** file and imported into Map Viewer 8 for their creation.

For contour maps the coordinates and analytical data were saved as an EXCEL file for use in a triangular, non-gridded computer program from ***Scientific Computer Applications Inc*** of Tulsa Oklahoma. After all that good work and expense with sampling and analysis the interpretation of the data and indeed any follow-up drilling based on that data can be compromised by an inaccurate contouring program. Gridding contour programs usually result in the data points not being honored, especially in the corners as well as along the edge of the surveyed area. Only two fundamental procedures are used by computers to generate contours from a random X-Y-Z set: indirect (gridding) and direct (triangulation). As pointed out above, Petro-Find uses a non-gridded computer program. The choice of grid size for wide-spaced data sets with clusters of high-density data can introduce additional errors.

The use of neon concentrations in geochemical soil gas surveys remains controversial.

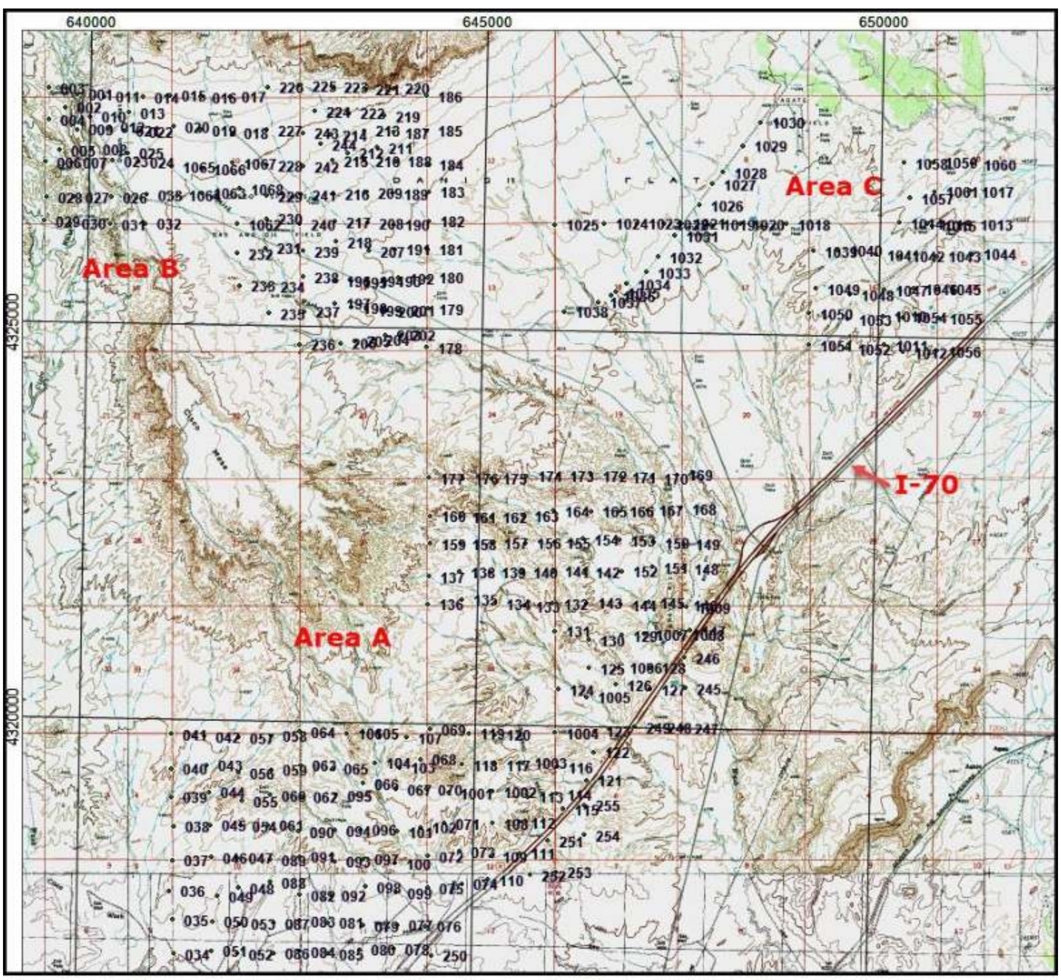


Figure 32. Cisco Spring geochem survey, Areas A, B and C

10. Results and Conclusions

A. Preamble

The objectives of the helium/HC survey were met: 1) Define potential areas of helium accumulation; and (2) define areas of petroleum accumulation for further field development.

In general, the bubble map of the 323- sample-point geochemical soil gas survey, divided into three Areas A, B and C, shows extensive and inter-connecting helium and hydrogen anomalies in all areas (Figures 33 and 34). Hydrogen, which correlates with methane, is used to differentiate between heavy and light oils for each petroleum system (Figure 39)

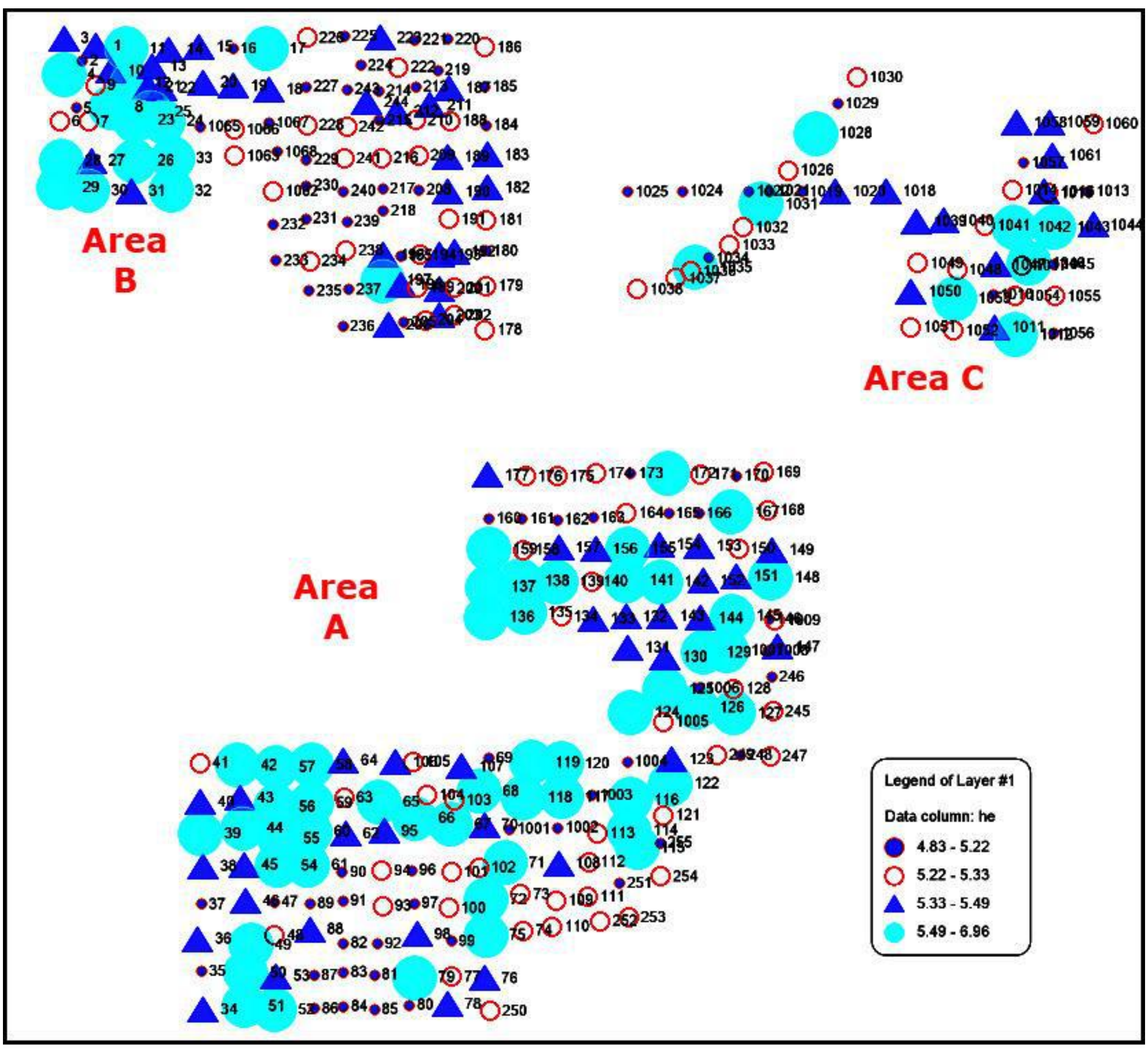


Figure 33. Cisco helium bubble map Areas A, B, C

B. Petroleum Systems

Three petroleum systems are indicated. Two of the systems are shown using plots of methane/ethane and methane/pentane: one with a heavy oil signature and the other, a light oil/condensate/rich gas signature (Figures 35 and 35A). The two ratios are used extensively in this report to determine gas and oil prone areas and prospective reservoirs in Area A, but not in Areas B and C because of heavy biodegradation of ethane in the samples (Table 1). Ethane is absent in 24 % of samples in Area A, 54% in Area B and 83% in Area C. The third petroleum system is dry gas located in the north portion of Area B. This system is not observed in C1/C2 and methane/pentane plots because dry gas does not contain pentane and only minor amounts of ethane if any.

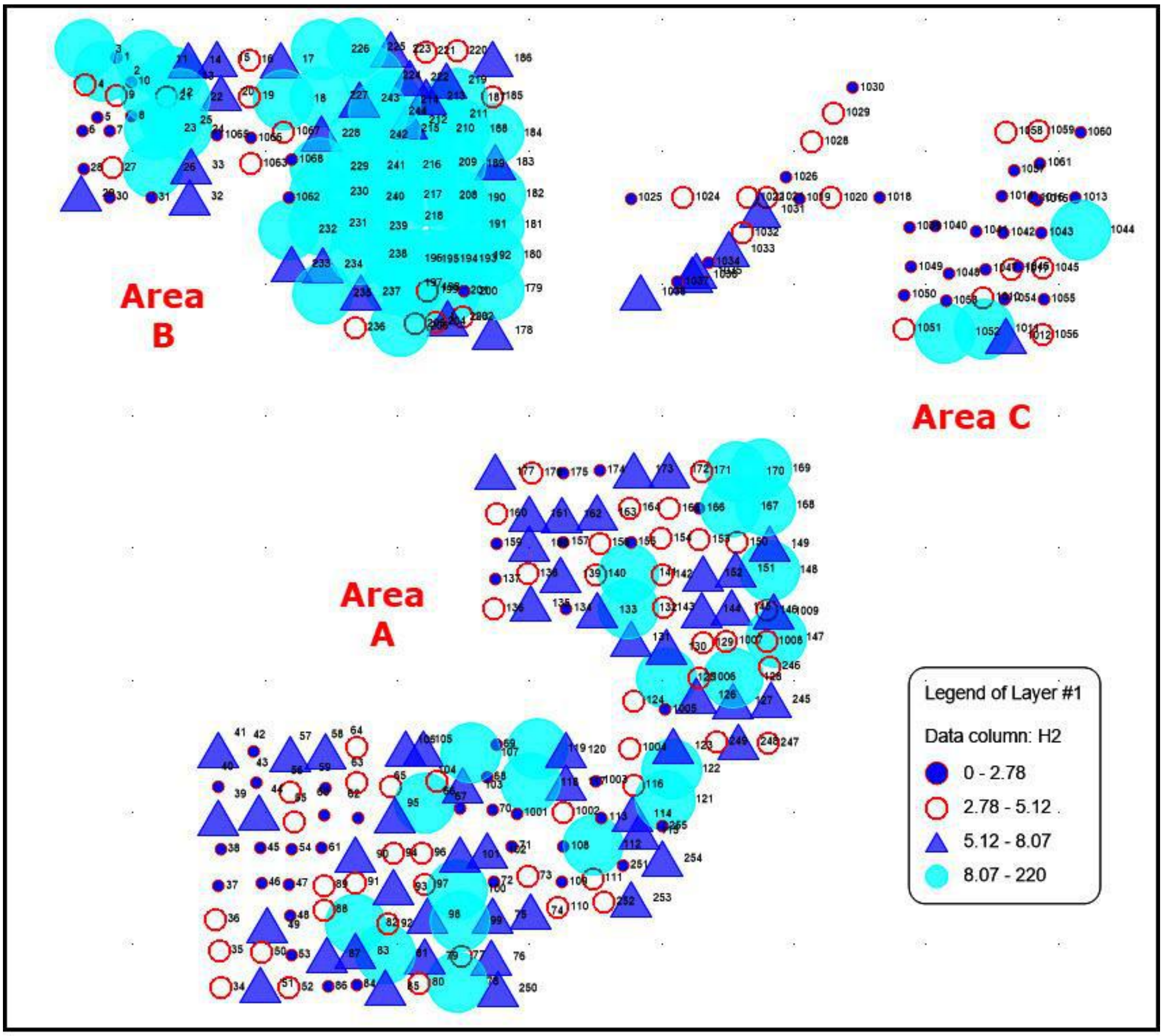
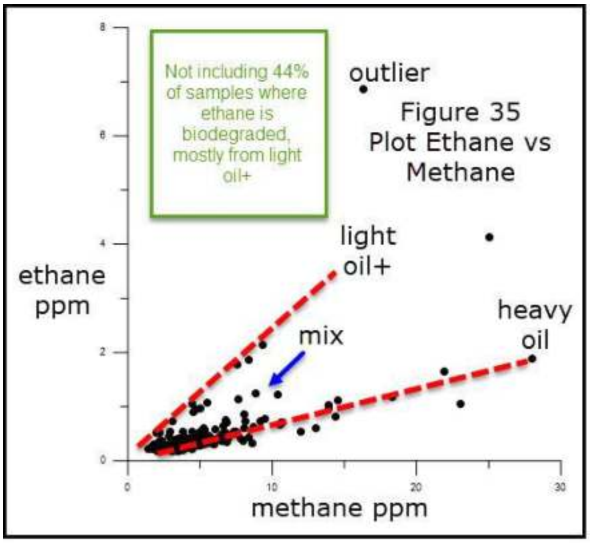
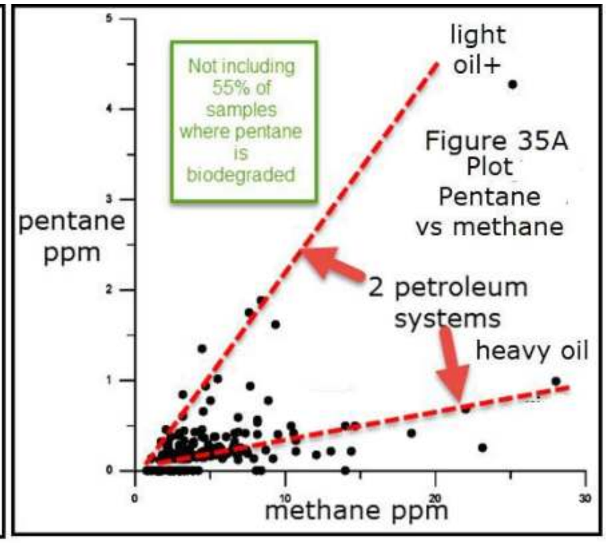
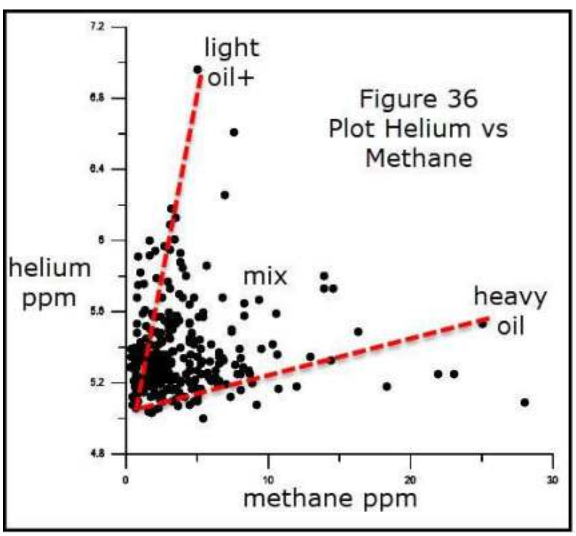
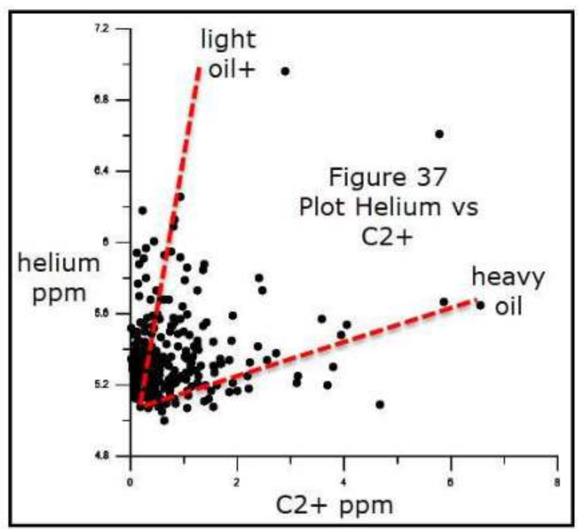


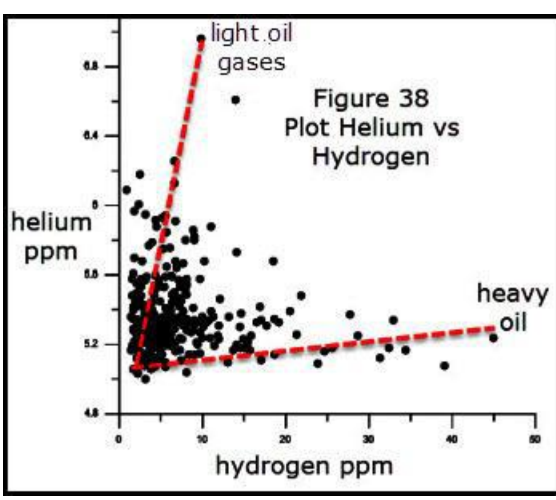
Figure 34. Cisco hydrogen bubble map Areas A, B, C

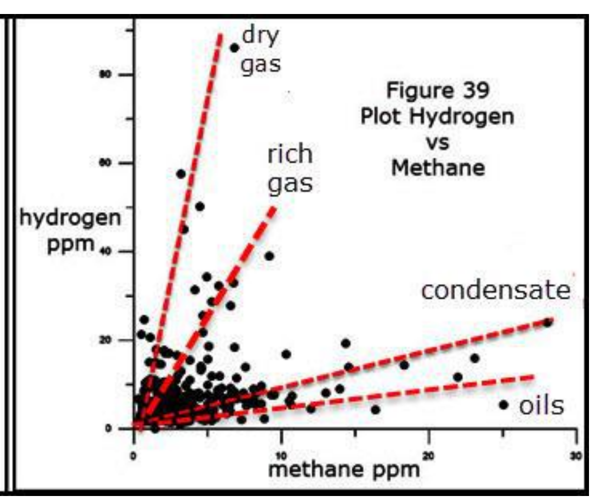

Not including 44% of samples where ethane is biodegraded, mostly from light oil+
outlier
Figure 35
Plot Ethane vs Methane
ethane ppm
light oil+
mix
heavy oil
methane ppm


Not including 55% of samples where pentane is biodegraded
light oil+
Figure 35A
Plot
Pentane
vs methane
pentane ppm
2 petroleum systems
heavy oil
methane ppm


light oil+
Figure 36
Plot Helium vs Methane
helium ppm
mix
heavy oil
methane ppm


light oil+
Figure 37
Plot Helium vs C2+
helium ppm
heavy oil
C2+ ppm


light oil gases
Figure 38
Plot Helium vs Hydrogen
helium ppm
heavy oil
hydrogen ppm


dry gas
rich gas
Figure 39
Plot Hydrogen vs Methane
hydrogen ppm
condensate
oils
methane ppm

.

Helium is found to correspond with rich gas from light oil and C2+ for each of the petroleum systems (Figures 36 and 37). It should be noted that the interpretation of hydrocarbons in soil gas as a means to identify oil reservoirs is compromised by the heavy biodegradation of ethane that affects both the C1/C2 and C2+ pathfinders. In the absence of hydrocarbons in the samples, nitrogen is deemed to be the associated gas with helium in the Entrada Formation

C. Helium and Hydrocarbon Anomalies – General

Significant helium anomalies were found in all three areas, but principally in Areas A and B. Helium is associated with both nitrogen and petroleum gases such as condensates and rich gas. All anomalous patterns of helium are deemed apical because of helium's inertness and its tendency to flow vertically upwards from reservoirs directly below. The finding of bypassed oil and gas reservoirs by C1/C2 and C2+ is less precise because of the extensive biodegradation of hydrocarbons such as ethane, which have disappeared in many samples, as well as oil/gas production over many years. CO2 concentrations indicate biodegradation is ongoing. Helium is unaffected by biodegradation and is likely to be associated with either condensates or rich gas of light oil reservoirs. The rich gas is likely to be found as a free gas in reservoirs.

It should be noted that one of the principal problems in interpreting geochemical data is distinguishing geochemical anomalies from dispersion patterns that occur from widening plumes of upward migrating helium due to lateral movement along bedding planes. In interpreting the geochemical pattern of an area containing anomalies, it is usually possible to select a certain limiting cut-off or "threshold" value below which the variations represent only normal background and dispersion effects above which they have significance in terms of indicating a possible reservoir at depth. The background is the concentration of helium in ambient air i.e. 5.1 ppm. The true anomaly that is representative of a reservoir could be larger or smaller depending on what is the cut-off point. A wide dispersion aureole around the high-grade core of anomalies indicates a reservoir that is deep-seated. For the purpose of this report a value of 5.5 ppm is taken as the cut-off point for the surface representation of helium reservoirs.

Whether the helium and oil anomalies represent commercial reservoirs will depend on follow-up drilling as well as seismic. Some anomalies will need to be defined with infill sampling and others will need to be traced beyond the limits of the current survey.

D. Helium Prospect Generation

The outstanding feature of the 323 sample-point geochemical soil gas survey was the discovery of a major helium anomaly of about 421 acres in size that is open in all directions in Area B. From the data, the association of helium with nitrogen (Prospect #1) is straightforward: hydrocarbons are absent except for minor amounts of methane, probably transient in nature.

Significant helium anomalies were found in all three areas (Figure 33) that represent helium reservoirs directly below. Helium anomalies are associated with both nitrogen (in Area B) and the gases of the light oil system i.e. rich gas and condensate (in all areas). A correlation of helium with type of reservoir using pathfinders such as C1/C2 and C2+ is rendered difficult because of previous production of oil and gas that has depleted the reservoirs with concomitant decrease in the driving pressure.

a. **Helium Prospect #1 – Association with nitrogen**

The outstanding feature of the 323 sample-point geochemical soil gas survey was the discovery of a major helium anomaly of about 421 acres in size at the 5.5 ppm level that is open in all directions in Area B (Figures 40 and 41). This prospect is open to the north, west and south. The major concentration of 6.18 ppm is at sample point number 8. The conclusion can be drawn from the absence of C2+ in all samples that the helium is associated mainly with nitrogen. Host rock may be the Middle Jurassic Entrada Sandstone, the same as at Harley Dome 13miles to the NE. The anomaly appears to be asymmetrical with sharper dip on the west side. Red area to the west may represent a normal fault zone. It is posited that the fault zone has provided a seal for the proposed helium reservoir. Like at Harley Dome the reservoir pressure may be low.

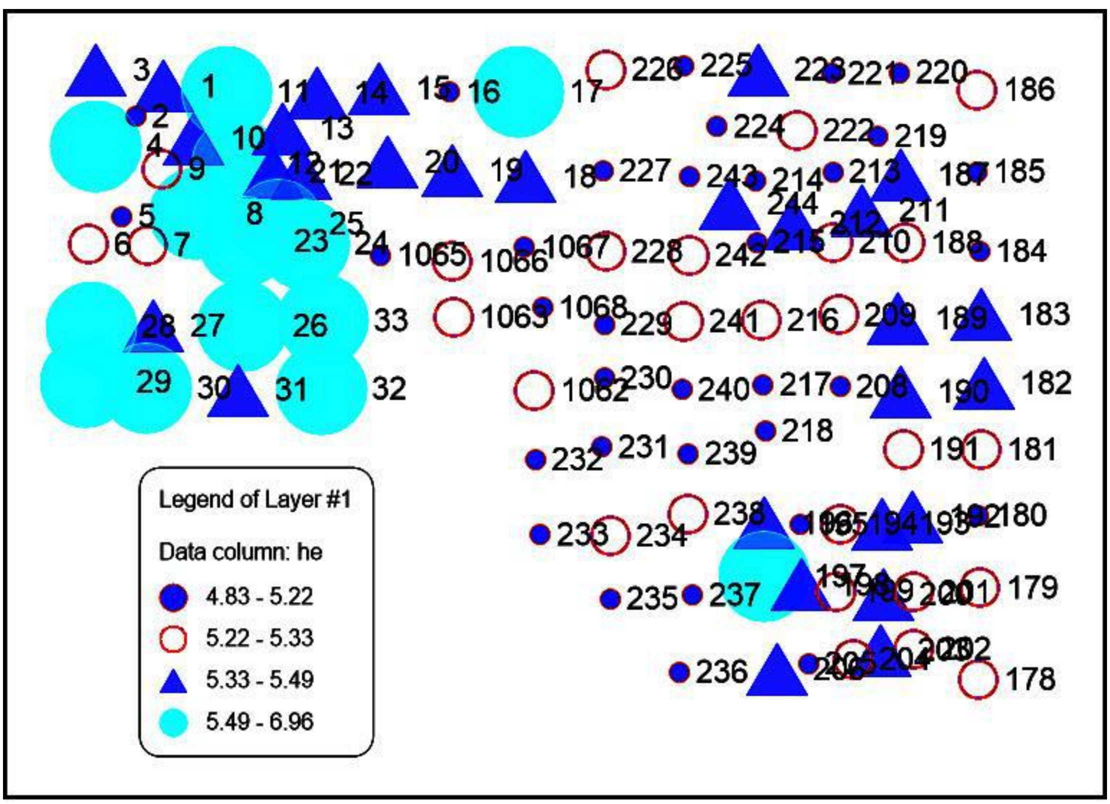


Figure 40. Cisco helium bubble map Area B

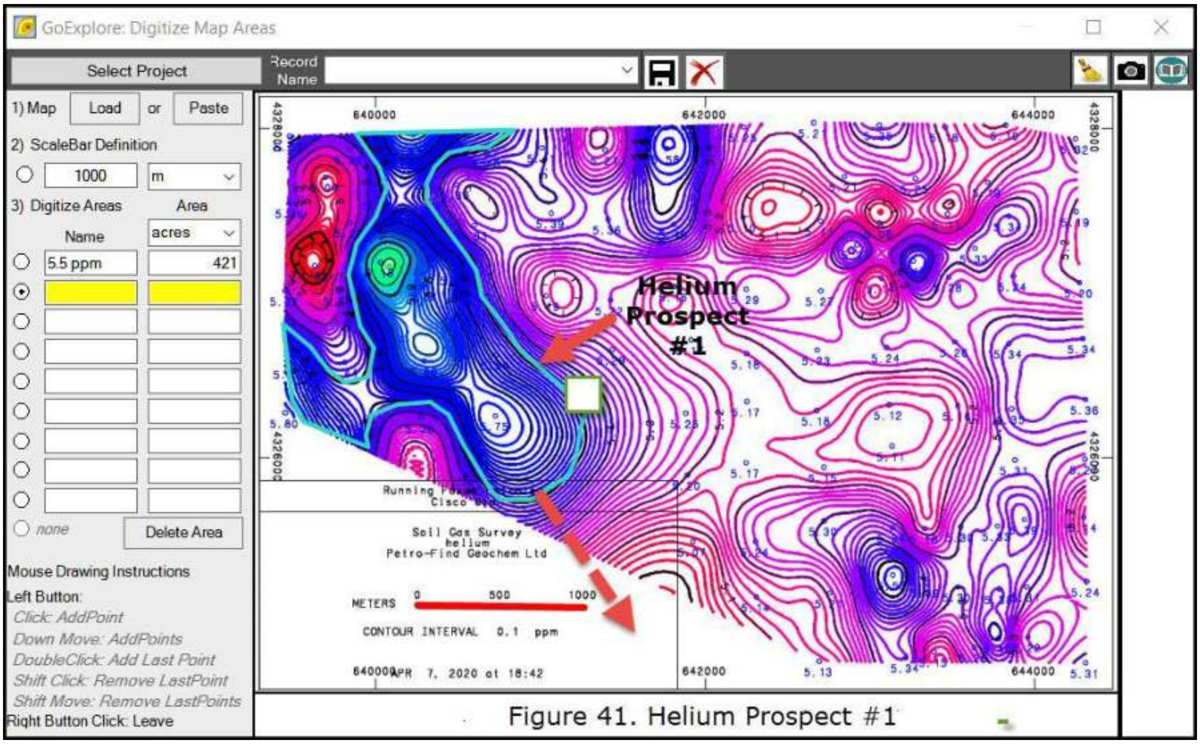


Figure 41. Helium Prospect #1

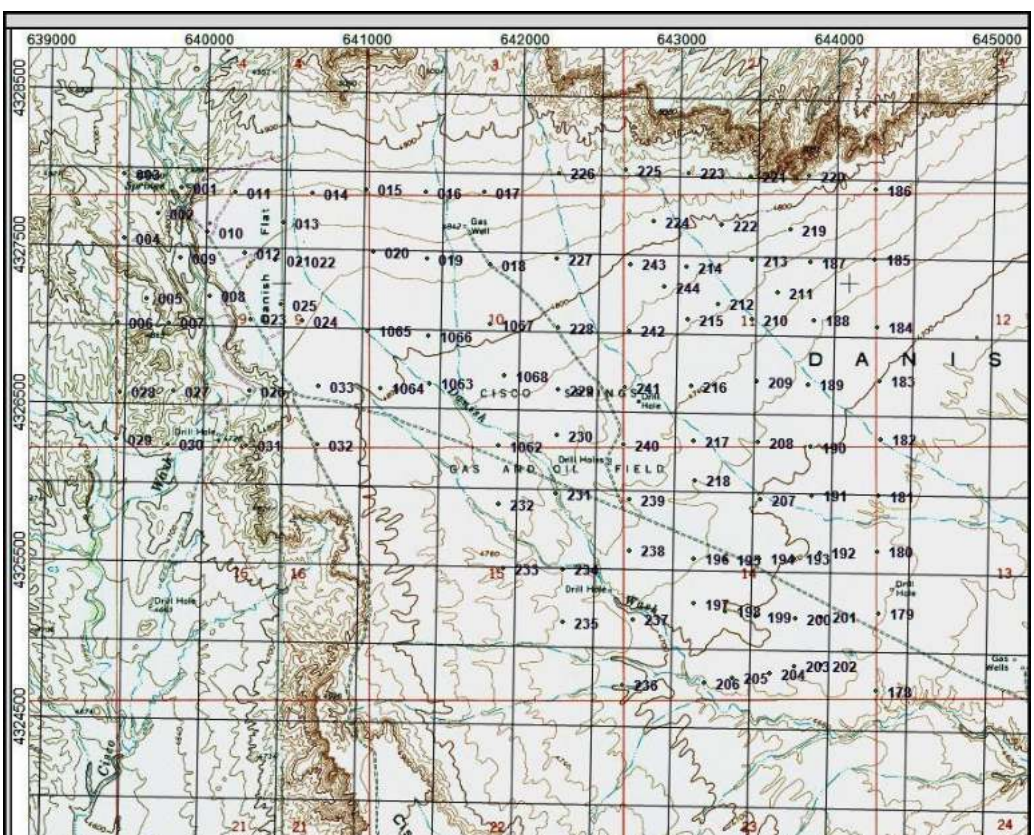


Figure 42. Cisco Springs Area B

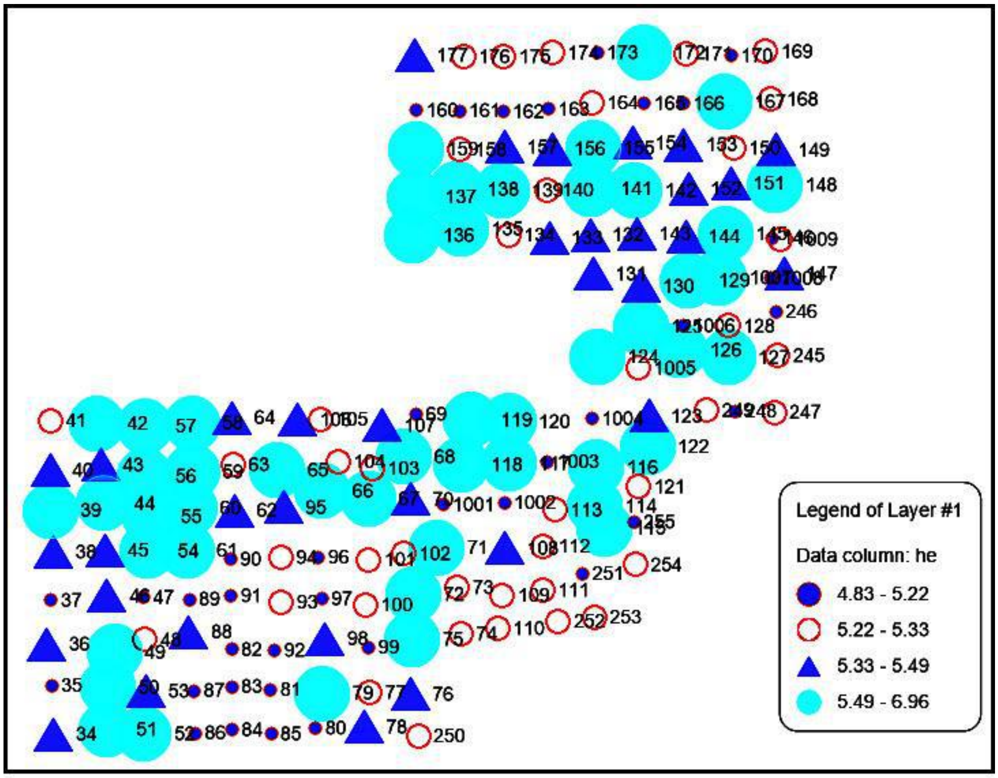


Figure 43. Cisco helium bubble map Area A

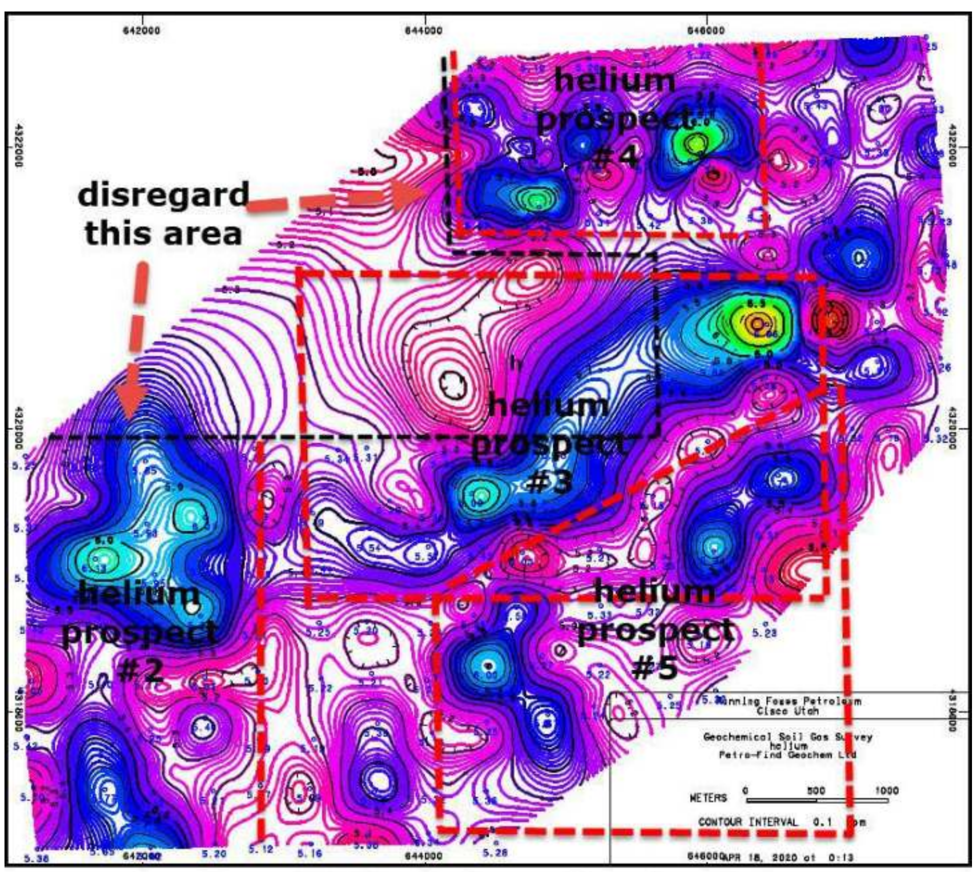


Figure 44. Cisco helium contours Area A

b. Helium Prospect #2- Association with Light Oil/Condensate/Rich Gas

Helium Prospect #2 at the 5.5 ppm level is 375 acres in size open to the north and may be connected at the 5.4 ppm level to an area the south comprising 115 acres (Figures 44 and 45). Low C2+ indicates the helium is associated with gases of the light oil system. Prospects #1 in Area B and #2 in Area A may be on the same trend and if so, more such types of reservoirs will be discovered in between. Consideration should be given to a geochemical soil gas survey to bridge the two prospects that are six miles apart.

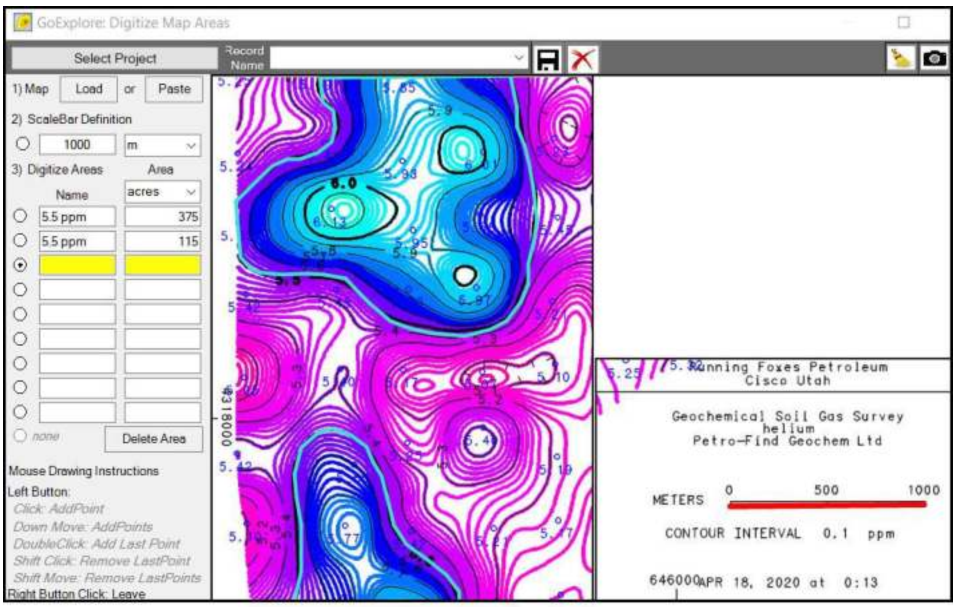


Figure 45. Helium Prospect #2 Area A

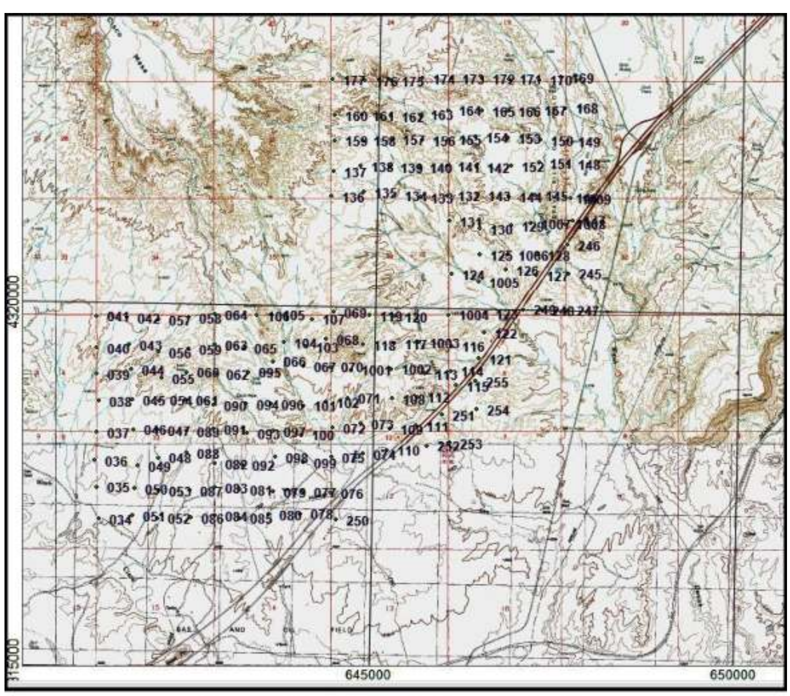


Figure 46. Cisco Springs Area A

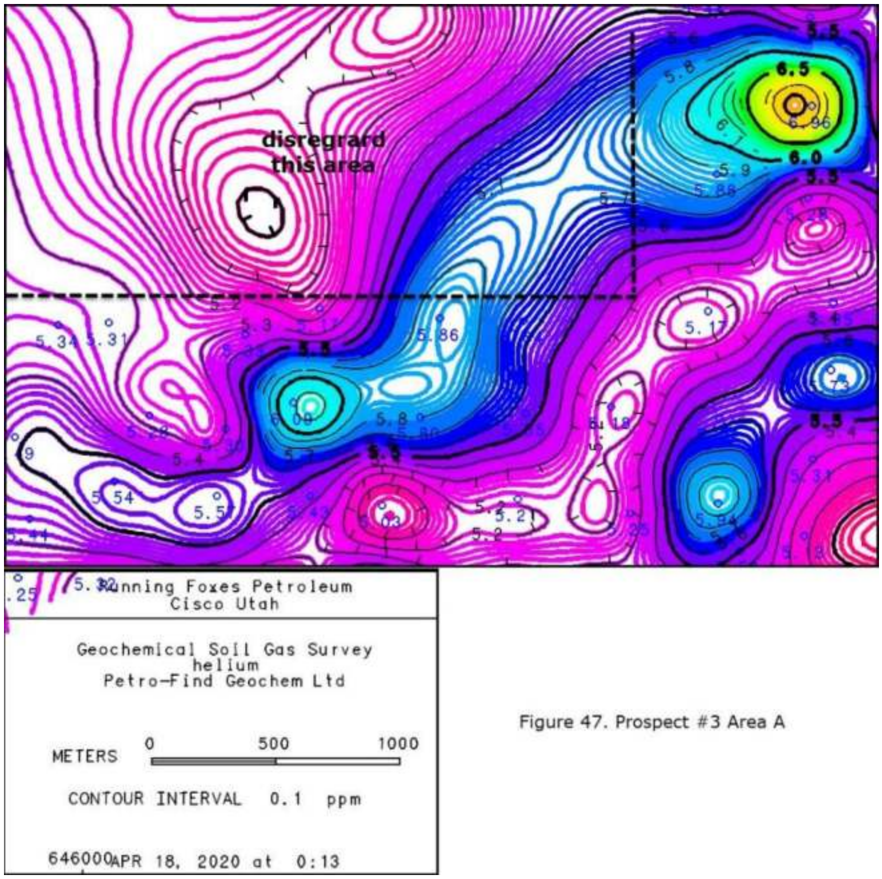


Figure 47. Prospect #3 Area A

c. Helium Prospect #3 – Association with Light Oil/Condensate/Rich Gas

Helium Prospect #3, 585 acres in size and about 3 km in length, may be connected by two high-grade helium anomalies at both ends (Figure 47). A great deal of sampling, both infill and exploratory, is needed to substantiate this hypothesis. The helium appears to be associated with a light oil system. To prove this up will require geochemical soil gas sampling in between.

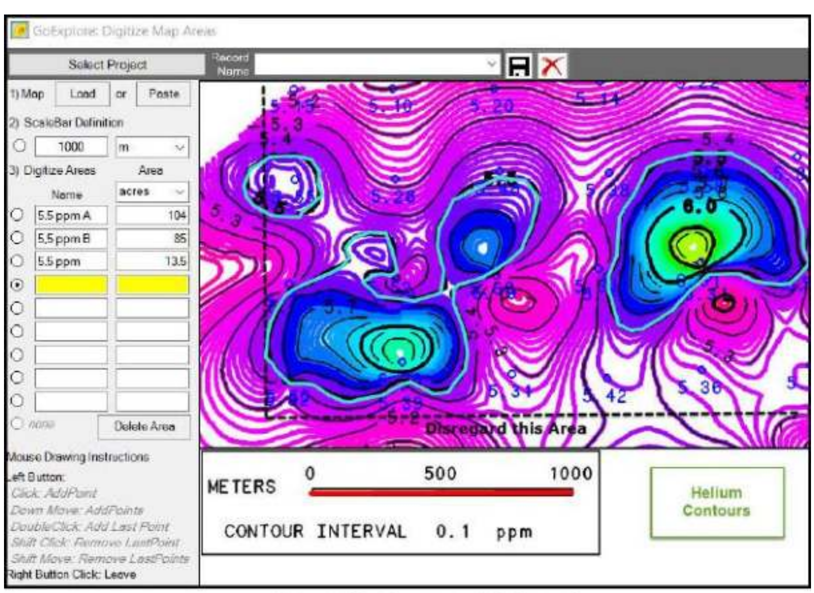


Figure 48. Prospect # 4 Area A

d. Helium Prospect #4 – Association with Light Oil/Condensate/Free Gas

At the 5.5 ppm level Prospect # 4 consists of three anomalies with a total area of about 202 acres (Figure 48). The three are connected at the 5.4 ppm level that increases drainage possibilities were they considered for development. The anomalies are all gas prone except the easterly high-grade anomaly, which is light oil prone.

e. Helium Prospect #5 – Association with Light Oil/Condensate/Rich Gas

At the 5.5 ppm level Prospect #5 consists of two anomalies with a total area of about 230 acres. The two anomalies may be connected at the 5.3 ppm level that increases drainage possibilities. This prospect requires further sampling to substantiate.

f. Helium Prospect #6 – Association with Light Oil/Condensate/Rich Gas

Helium Prospect # 6 consists of four helium anomalies in Area C (Figures 57A and 58). A follow-up soil gas survey to infill and extend the anomalies beyond the border of the current survey would be required to realize their full development potential.

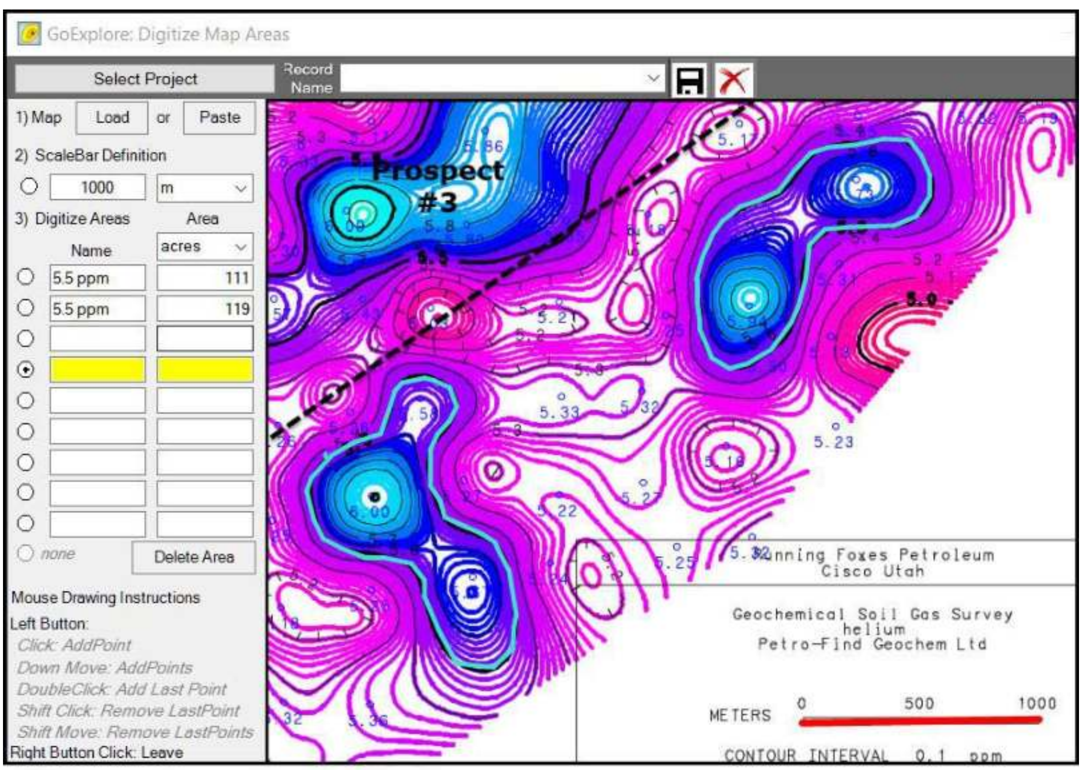


Figure 49. Prospect #5 Area A

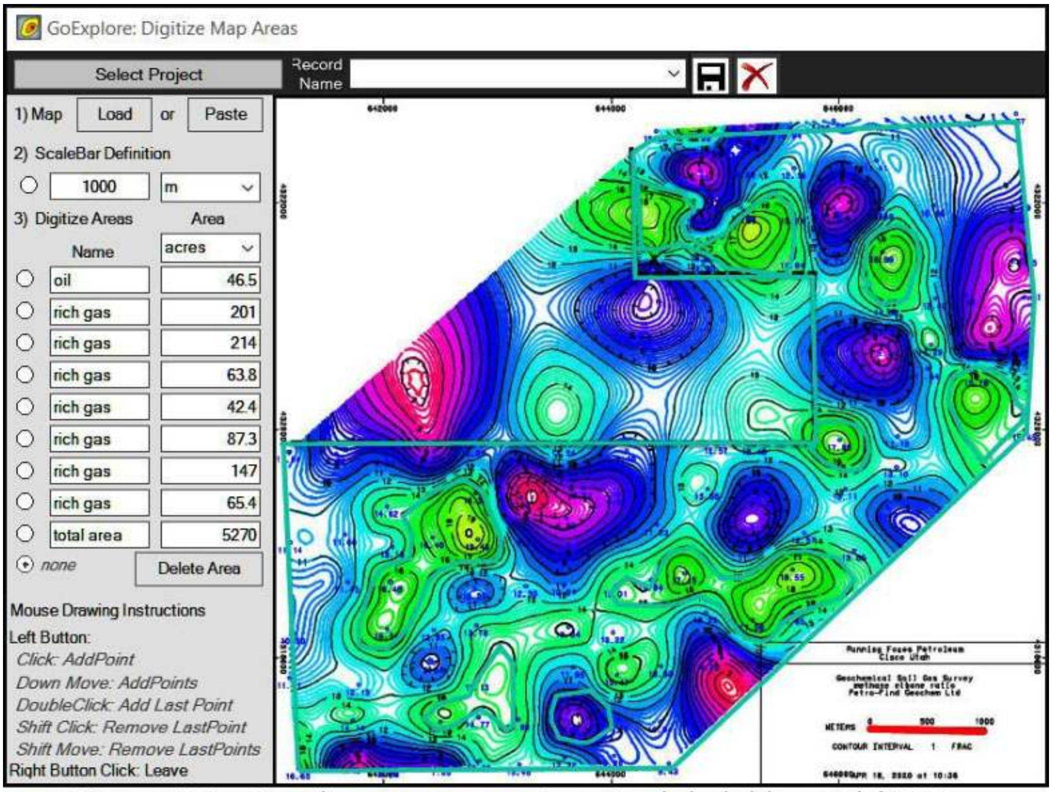
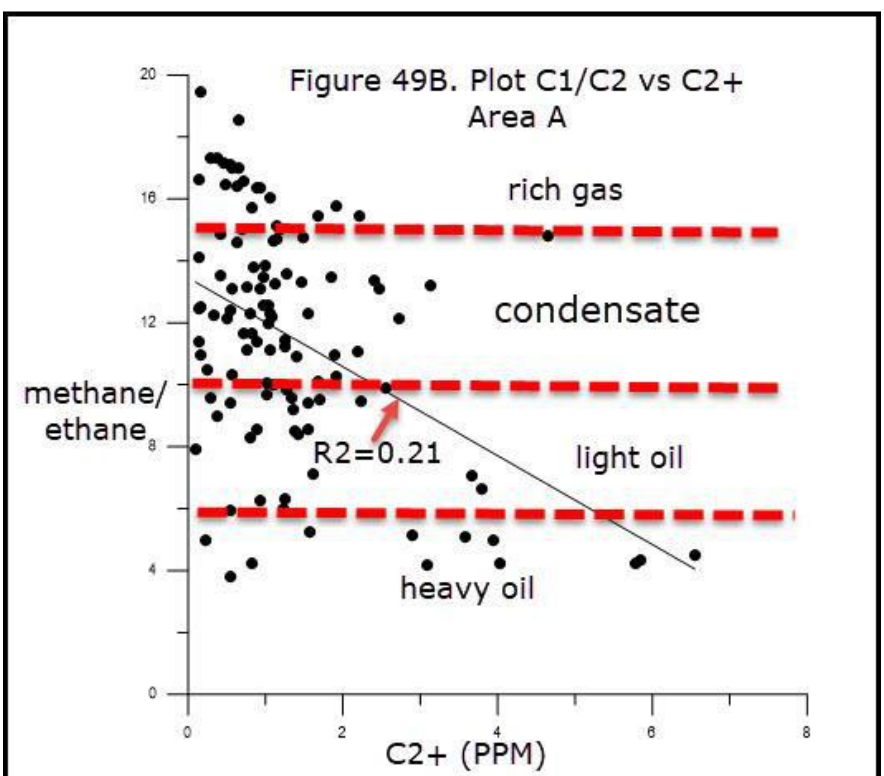


Figure 49A . Petroleum prospects Area A:oil dark blue-red (1232 acres); condensate light blue (3119 acres); rich gas green (819 acres)



E. Petroleum Prospect Generation

Three petroleum systems were detected in the project area: heavy oil, light oil with associated condensate and rich gas, and thermogenic dry gas in the north portion of Area B (Figures 35 and 35A). The heavy dark oil is Pennsylvanian that is probably sourced from the Phosphoria formation and perhaps the Hermosa formation; the light oil is sourced from the Dakota Formation (Information source: communication with Tedesco). Samples of dry gas could be subjected to stable carbon and hydrogen isotope analysis to determine their origin.

The C1/C2 ratio was used to locate and determine the aerial extent of the petroleum anomalies, and C2+ to gauge the strength of these anomalies as well as confirm type of reservoir. A plot of C1/C2 vs C2+ reveals an inverse relationship i.e. rich gas has a lower C2+ values while heavy oil has the highest (Figure 49B). These two pathfinders were used extensively in this report to determine gas and oil prone areas and prospective reservoirs in Area A, but only to a limited extent in Areas B and C because of heavy biodegradation of ethane in pebbly soils to the north. Ethane was absent in 24 % of samples in Area A, 54% in Area B and 83% in Area C. Thus, biodegradation increases northward from Area A to Area B and eastward to Area C. Halo-type anomalies from biodegradation could have had the same effect. The coincidence of high values of CO_2 and some HC anomalies indicates biodegradation is still ongoing.

Hydrogen was an important pathfinder for the light oil/condensate/rich gas in halo-type anomalies. Hydrogen's penetration of the impervious carbonate cap over halo reservoirs was useful in the discovery of major anomalies. Hydrogen in soils can be sourced from reservoirs but the signal is not definitive because it can be also produced by biodegradation and redox reactions. CO_2 contour maps for Areas A and B show halo anomalies that correlate with the condensate/rich gas anomalies found in the C1/C2 and hydrogen analysis.

Area B

The second outstanding feature of the geochemical survey was the discovery of a major anomaly estimated to be 477 acres in size consisting of light oil with associated condensates and rich gas at the south end of Area B (Figure 54C, 55) . It was detected using contoured maps of C1/C2 and hydrogen. CO_2 contour data, which showed a major halo anomaly at this location, explained the low values of C2+ and methane anomalies in this area (Figure 56A). The carbonate cap of the halo anomaly provided a barrier for upward migration of hydrocarbons. Another light oil anomaly of 72 acres was discovered on a major NW-trending fairway of condensate and rich gas that is considered to be very prospective**.** Two anomalies of thermogenic dry gas of 67 and 176 acres open to the north were found at the northern border.

Using C1/C2 data (based on 40% of samples) the petroleum in Area B is largely light oil and gas prone consisting of condensates, rich gas and dry gas (Figure 54A). A plot of methane versus ethane concentrations is linear confirming Area B is gas prone with condensates and rich gas predominating (Figure 54B).

Infill sampling would be required to obtain a clearer more definitive picture of all the anomalies. A pre-drill method for deeper sampling depth could be employed where necessary. Extension of these anomalies beyond the current borders of the survey could be considered as well. All new data would be merged with present data.

Area A

In Area A, three groups of oil and thermogenic gas prospects based on C1/C2 anomalies were found (Figure 50). Hydrocarbons are ubiquitous in this area where, based on C1/C2 contours, anomalous areas of heavy and light oil comprise 1232 acres (range 10 or less), condensate 3119 acres (range 10-15) and rich gas 819 acres (15-20). The light oil system is comprised of light oil (i.e. in the 7-10 C1/C2 range), condensate (i.e. in the 10-15 C1/C2 range) and rich gas (i.e. 15-20 C1/C2 range).

The number and size of the 16 anomalies discovered in Area A are:
Range in Size Type
Prospect #1 six anomalies (Figure 52) - 132 to 357 acres – 3 light oil, 1 heavy oil, 2 rich gas
Prospect #2 six anomalies (Figure 53) 86 to 285 acres -3 light oil, 2 heavy oil, 1 rich gas
Prospect #3 four anomalies (Figure 54) - 77 to 340 acres – 1 light oil, 1 heavy oil, 1 rich oil, 1 condensate

While C1/C2 can determine the location and aerial extent of light oil (including condensates and rich gas) and heavy oil, C2+ ranks the anomalies in terms of their intensity i.e. whether or not they are good prospects worth pursuing. It should be noted that a plot of C1/C2+ versus C2+ show an inverse relationship (Figure 49B). Methane was found to be useful to differentiate between heavy and light oils (Figure 51A).

The condensate/rich gas anomalies (green and light blue colors in Figure 50) are all halo anomalies as shown by a correlation with the CO2 contour map (Figure 50A). Halo anomalies #1 and #2 are 1600 and 873 acres in size. The high CO2 anomalies that surround the halo anomalies are caused by: leakage of CO2 around the circumference of the halo anomaly as well as biodegradation of hydrocarbons emanating from reservoirs directly below.

The existence of apical anomalies directly over reservoirs is an established principle in geochemistry. However, apical anomalies may be modified by severe biodegradation which can reduce the size and shape of the anomalies (Annex 6). The halo type appears over reservoirs in areas where very active aerobic microbes in near-surface soils attack the upwardly migrating hydrocarbons. A typical doughnut shaped anomaly with low methane values in the middle directly over the reservoir with discontinuous high methane concentrations in the periphery. It is generally accepted that carbon dioxide produced from the biodegraded hydrocarbons reacts with water to produce carbonic acid which in turn reacts with calcium compounds to produce a calcium carbonate barrier. The calcium carbonate (calcite) can occur in soil profiles as caliche in desert environments or as marl in others. The near-surface calcium carbonate can act as a barrier to the upward migration of hydrocarbons except at the edges of the cap where high anomalous methane values can exist.

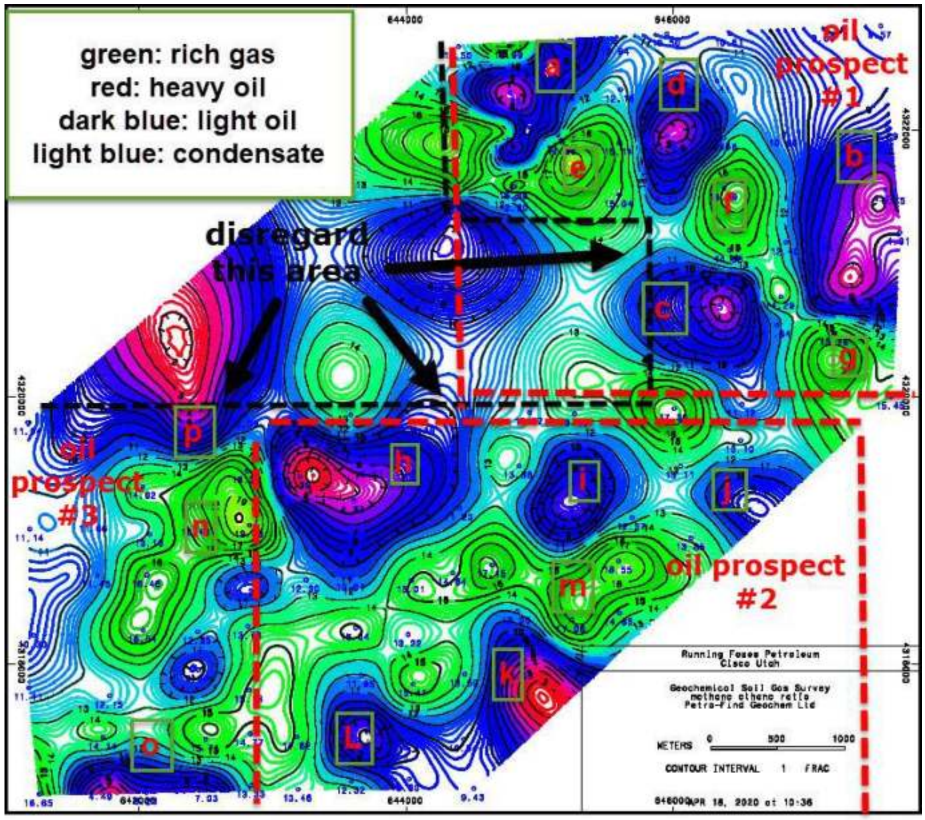


Figure 50. Ratio methane ethane Area A

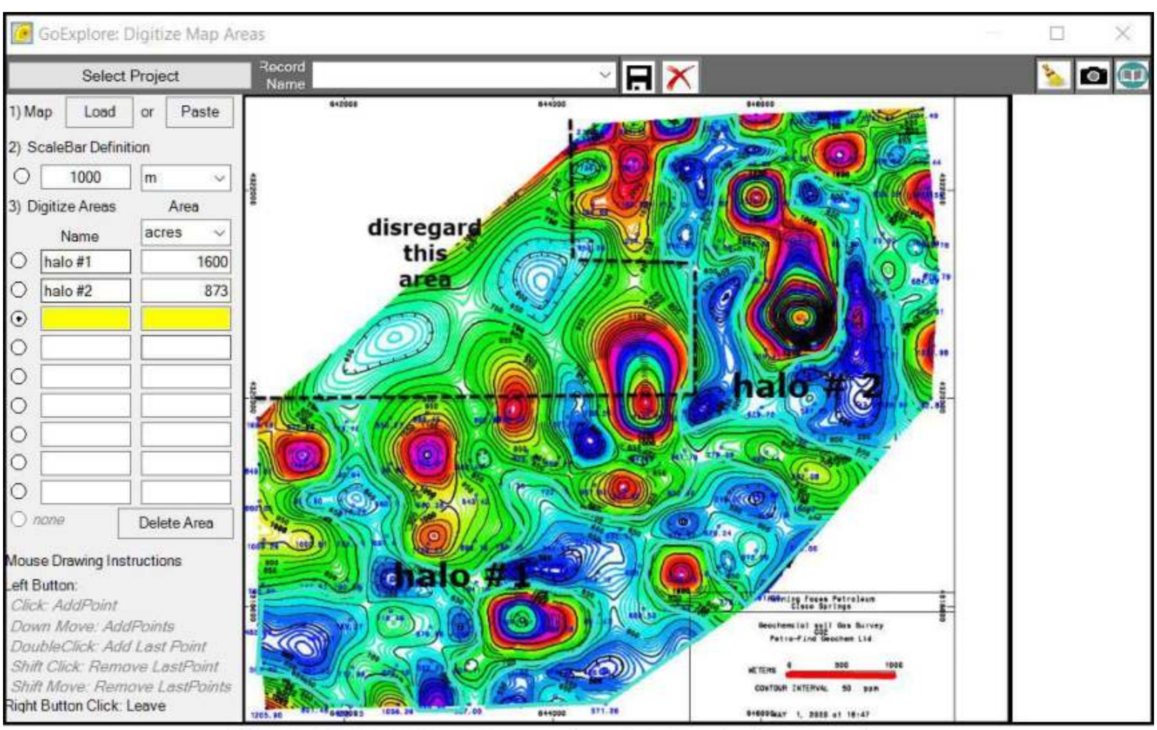


Figure 50A. CO2 contours showing two halo anomalies
light and dark blue -halo anomalies
green and multicolor-CO2 anomalies

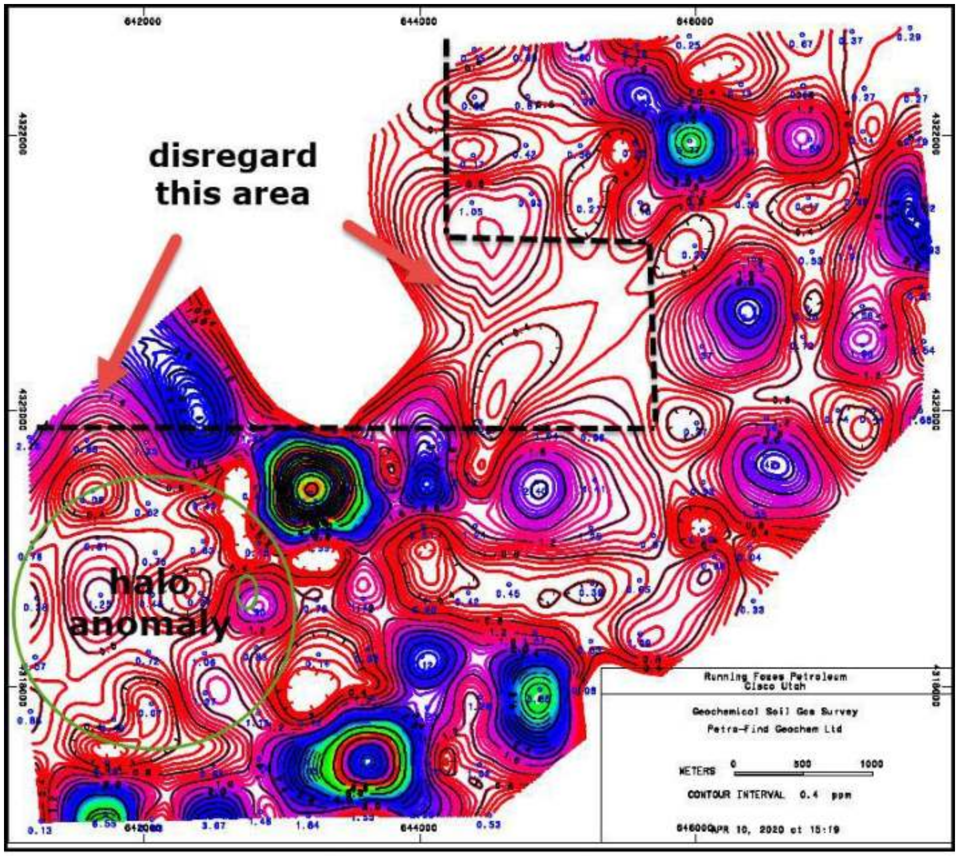


Figure 51. Contour map C2+ Area A

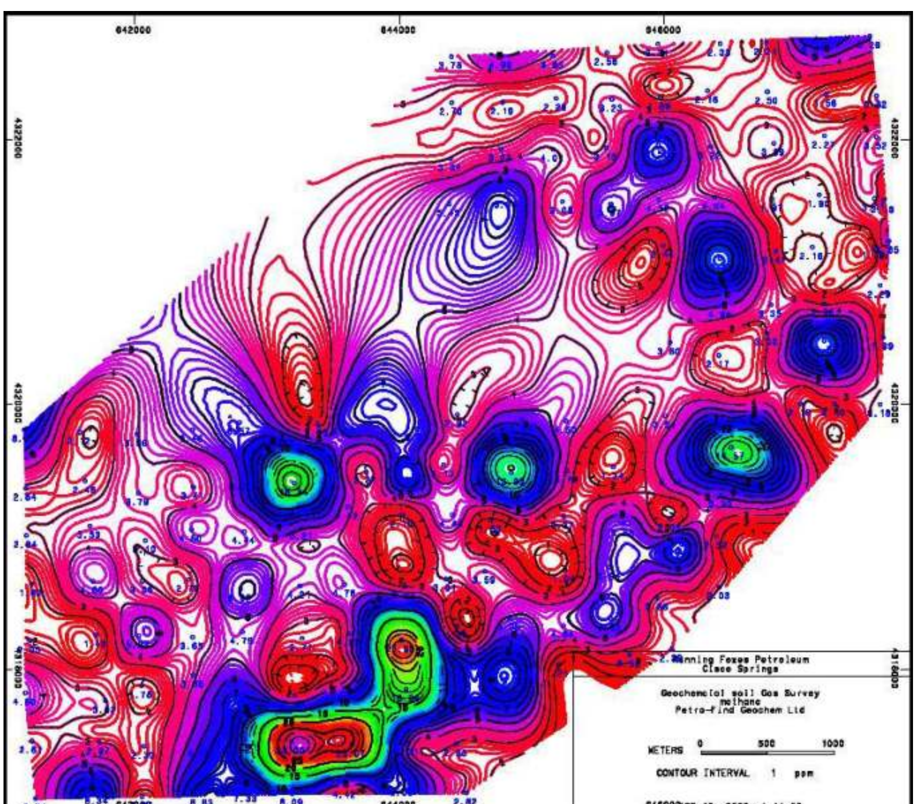


Figure 51A. Contour map methane Area A

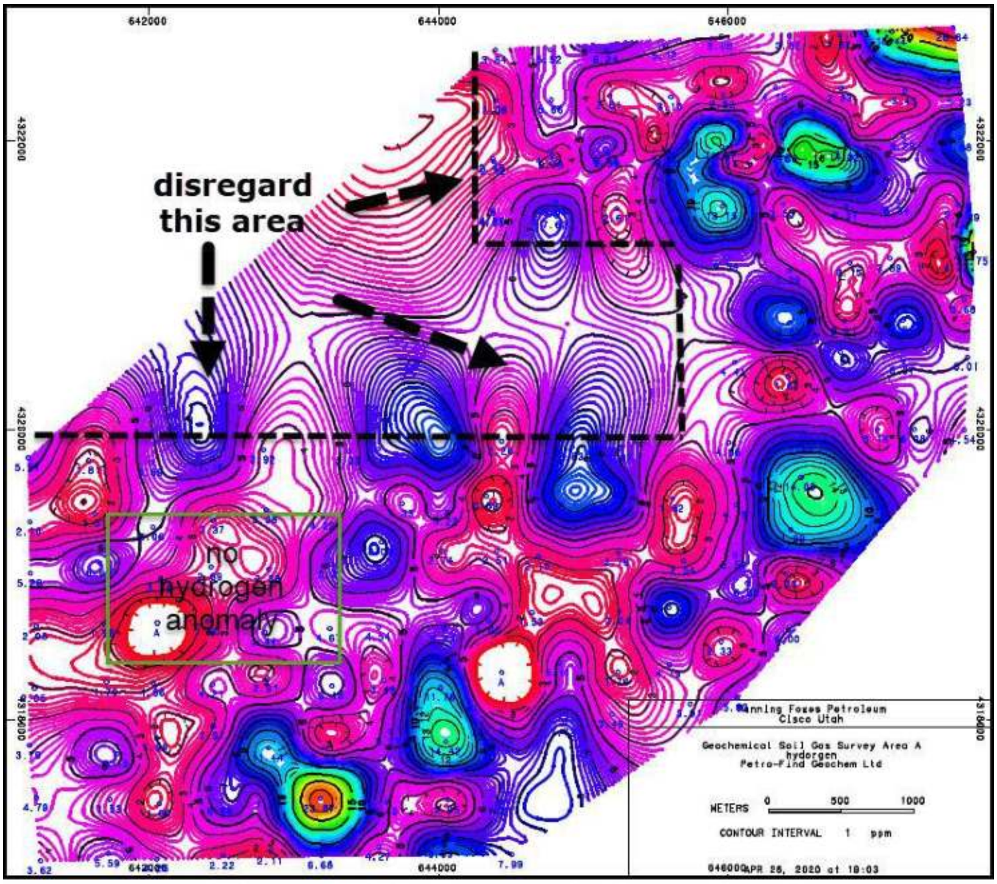


Figure 51B. Contour map hydrogen Area A

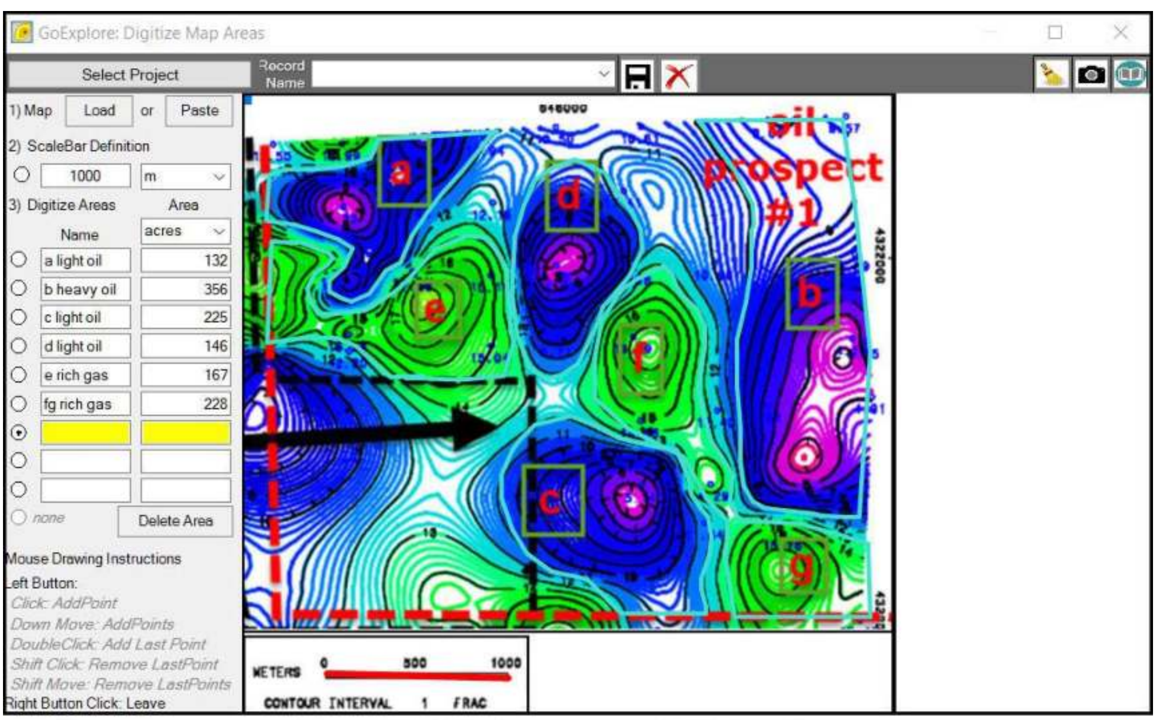


Figure 52. Petroleum prospect #1 Area A

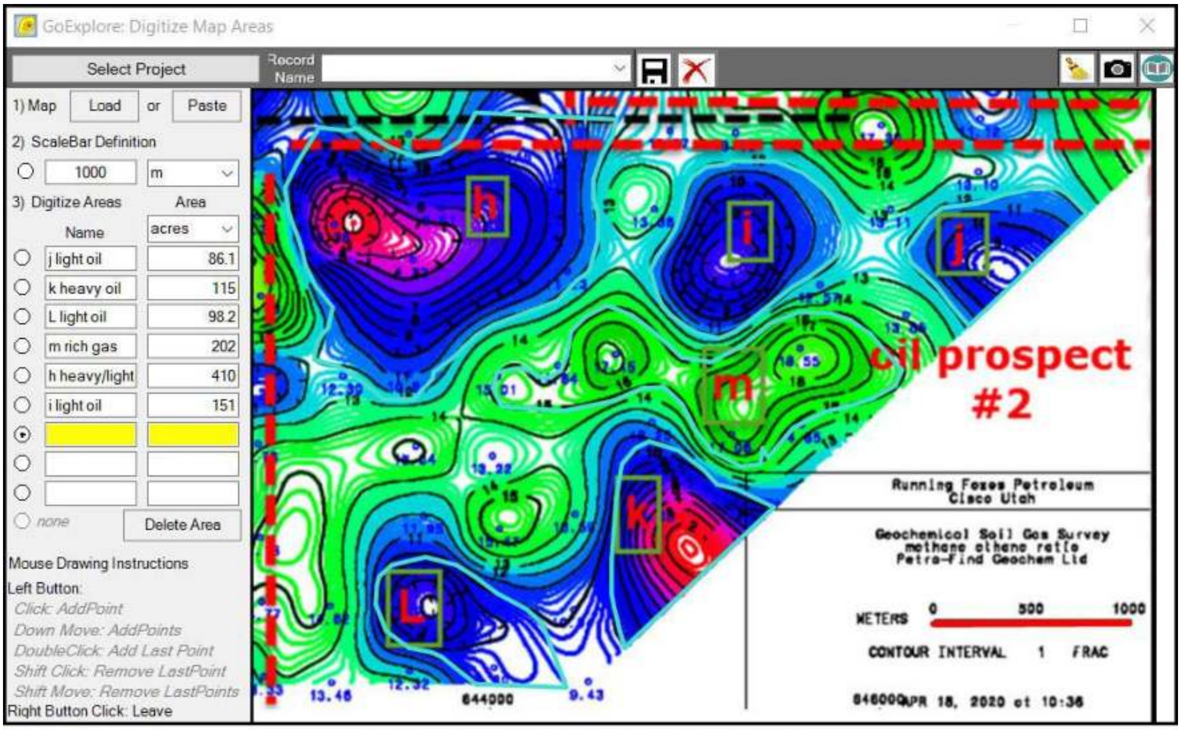


Figure 53. PETROLEUM PROSPECT #2

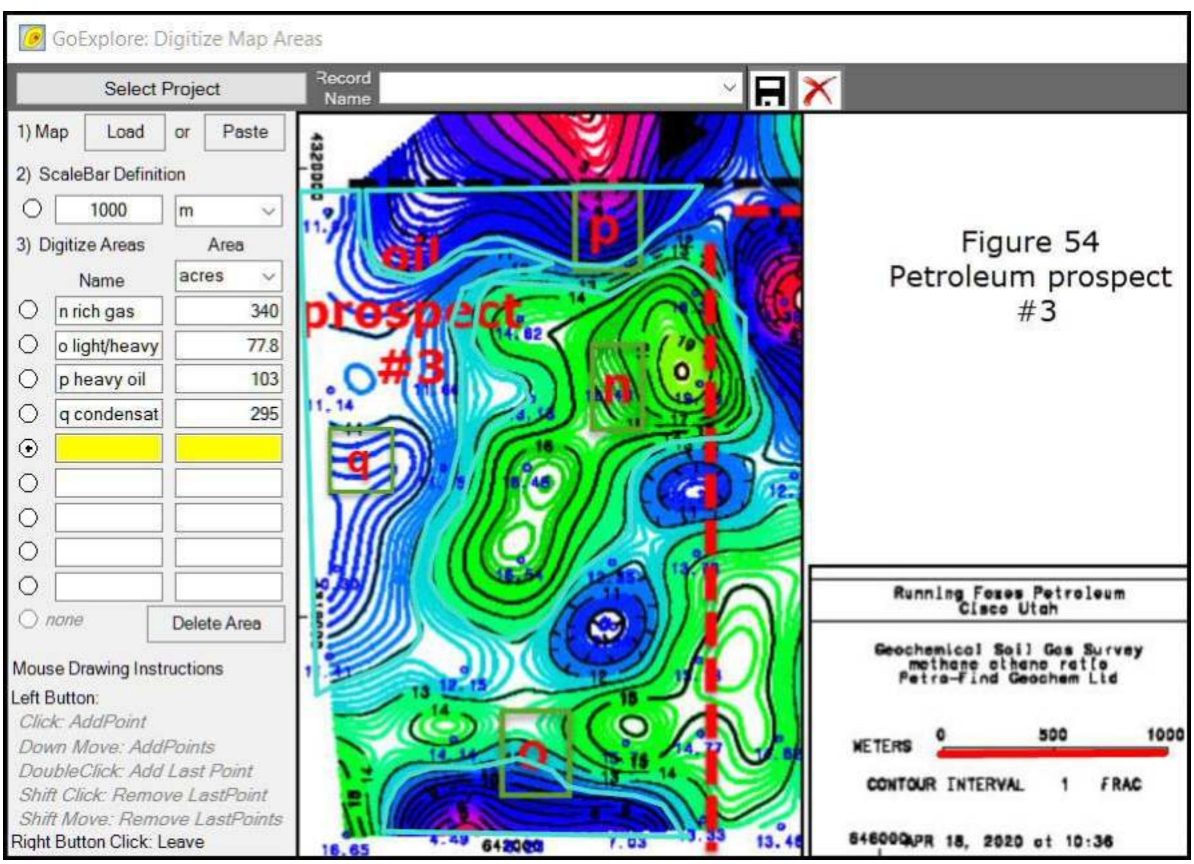
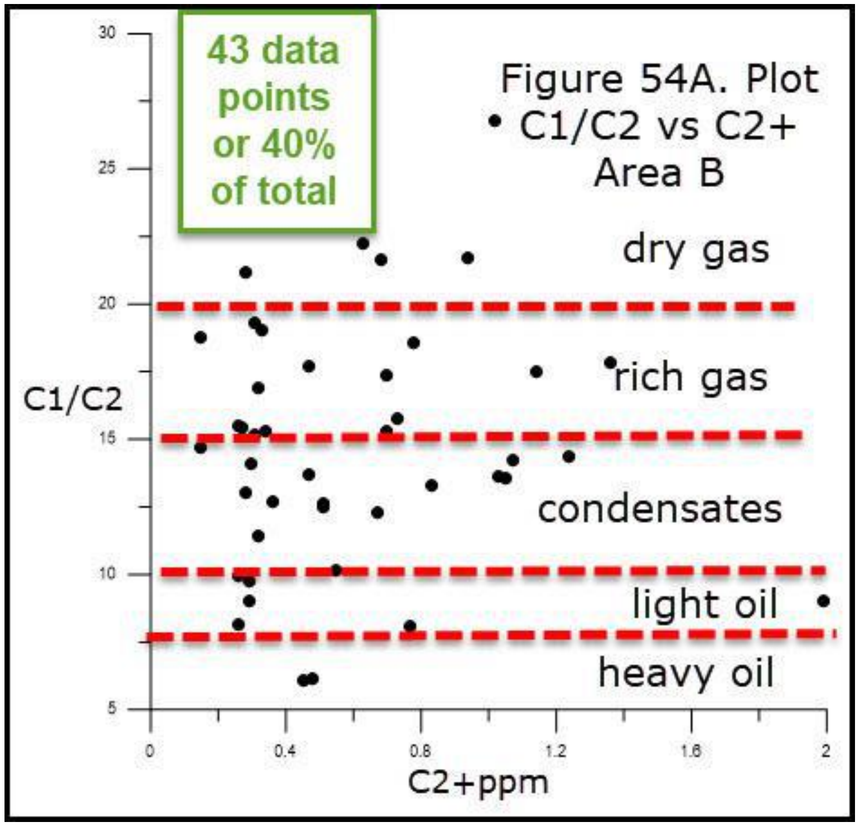
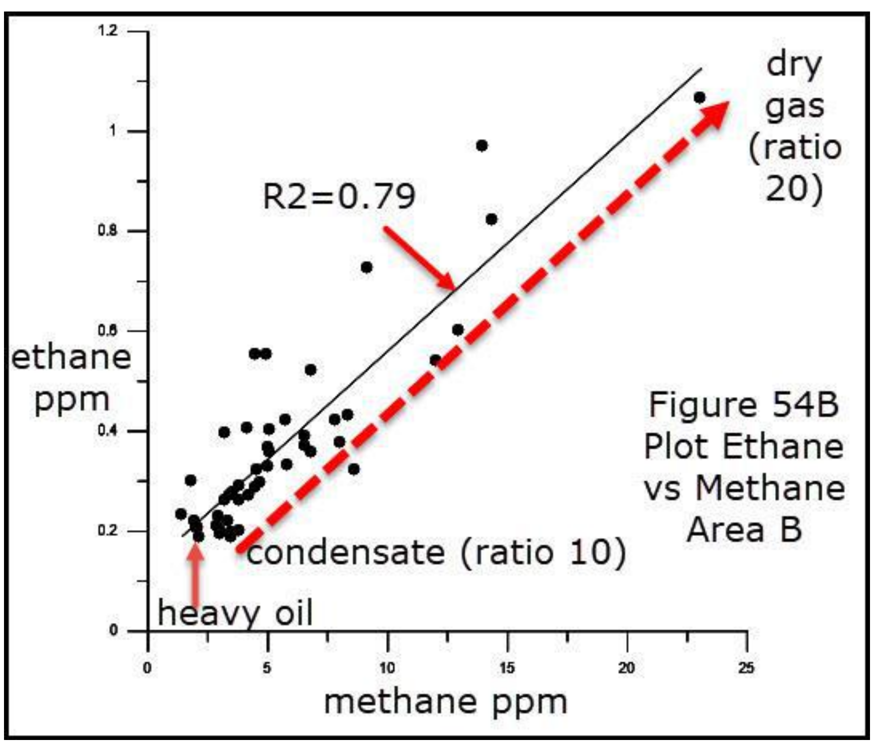


Figure 54
Petroleum prospect
#3


43 data points or 40% of total
Figure 54A. Plot C1/C2 vs C2+ Area B
dry gas
rich gas
condensates
light oil
heavy oil
C1/C2
C2+ppm
30
25
20
15
10
5
0
0.4
0.8
1.2
1.6
2


dry gas (ratio 20)
R2=0.79
Figure 54B Plot Ethane vs Methane Area B
condensate (ratio 10)
heavy oil
ethane ppm
methane ppm
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20
25

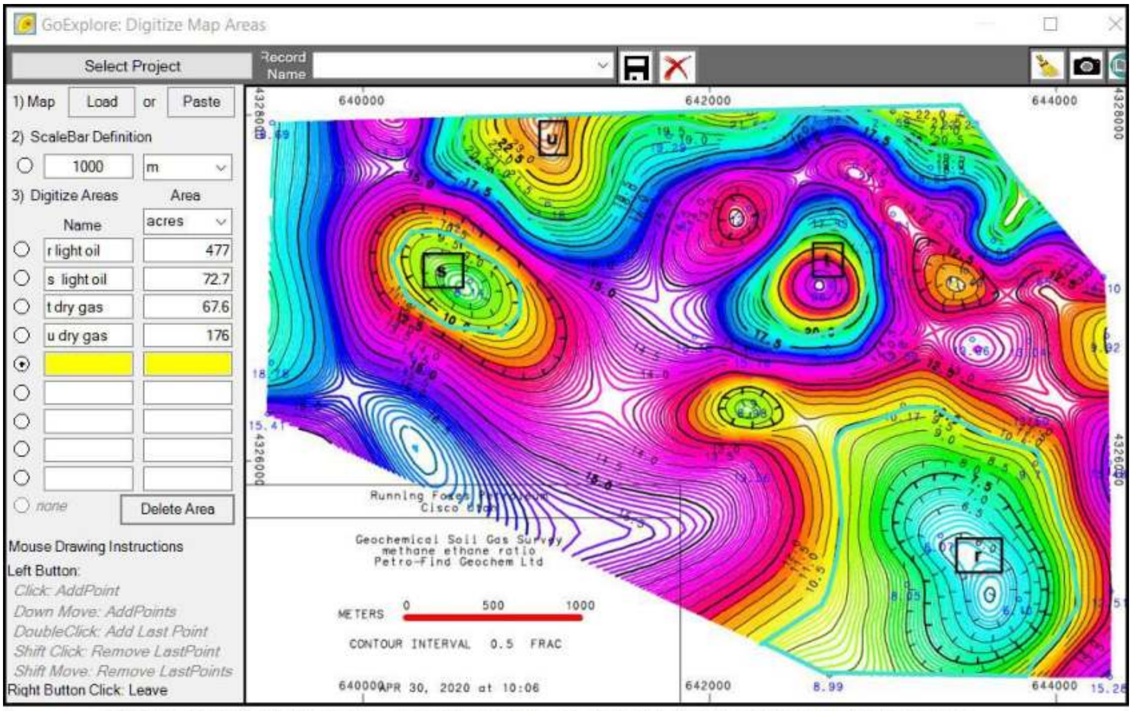


Figure 54 C. Petroleum prospects r to u determined by methane/ethane ratio Area B

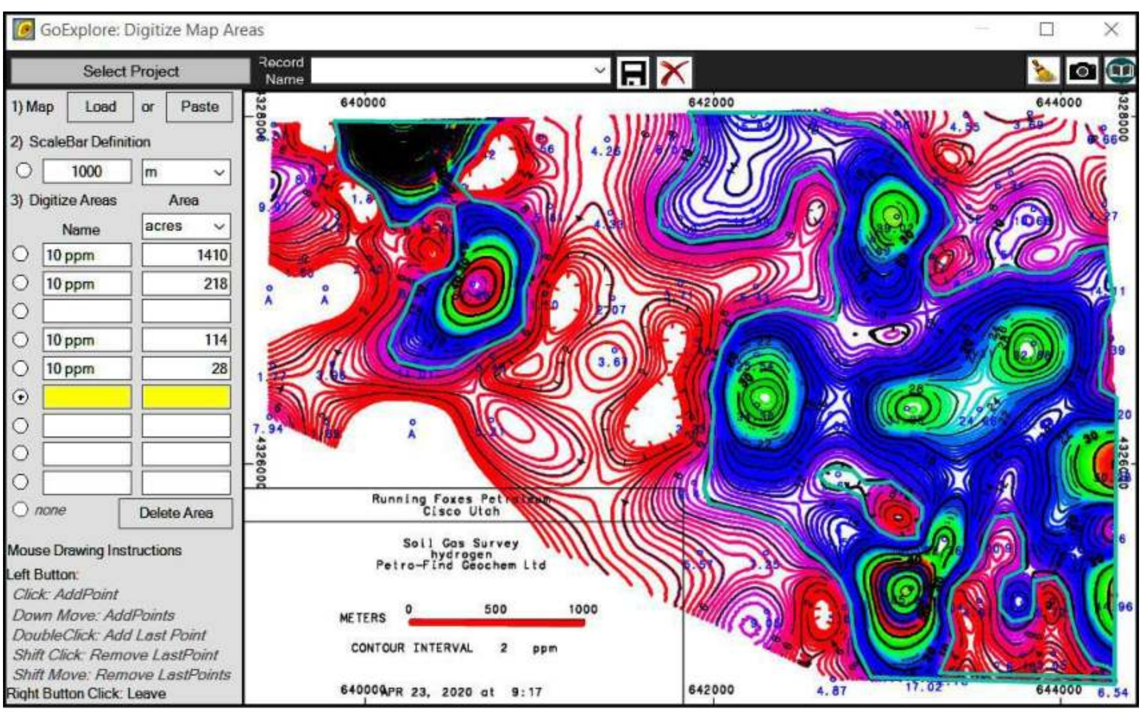


Figure 55. Petroleum prospects determined by hydrogen concentrations Area B

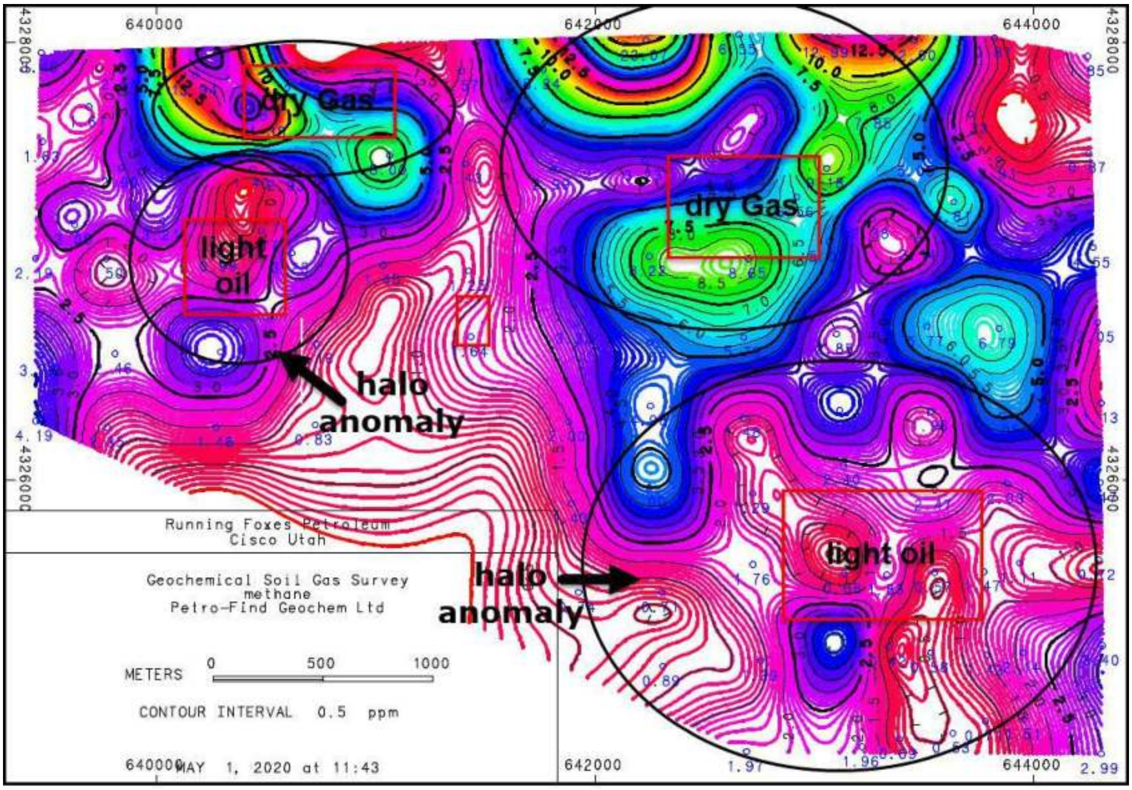


Figure 55A. Methane contours Area B

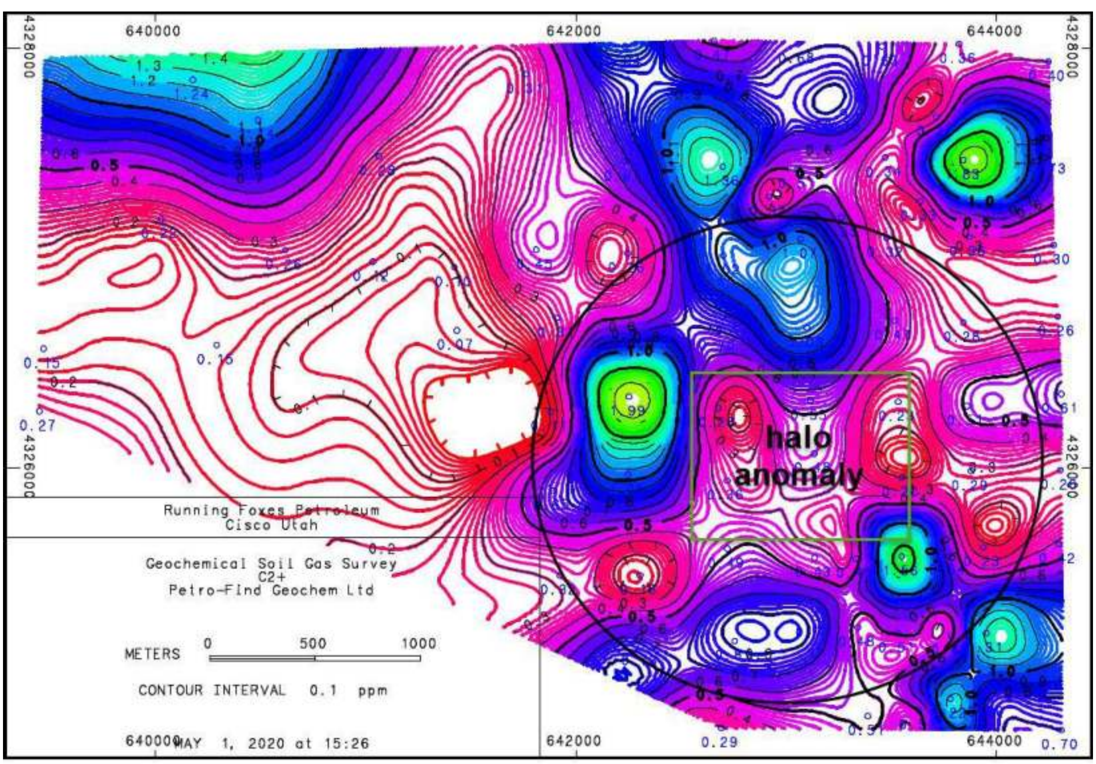


Figure 56. Petroleum prospect determined by C2+ concentrations Area B

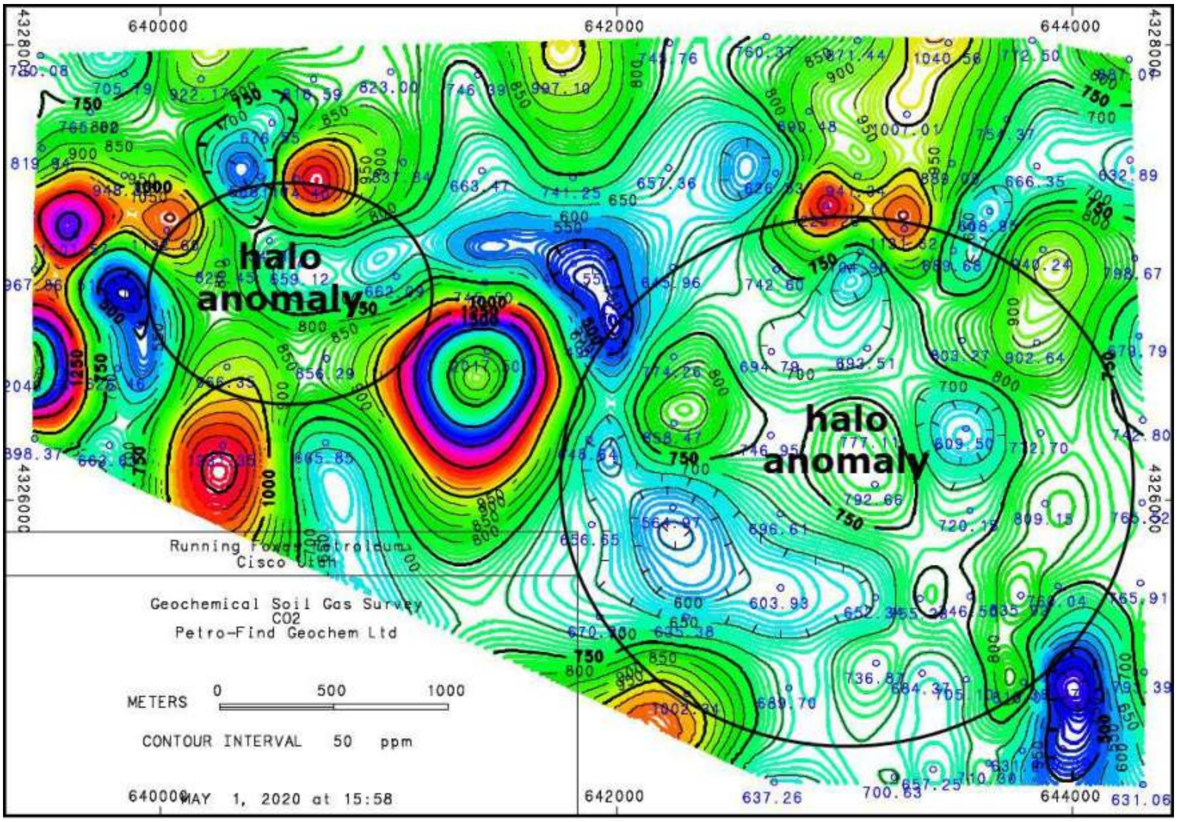


Figure 56A. CO_2 contour map showing two halo anomalies

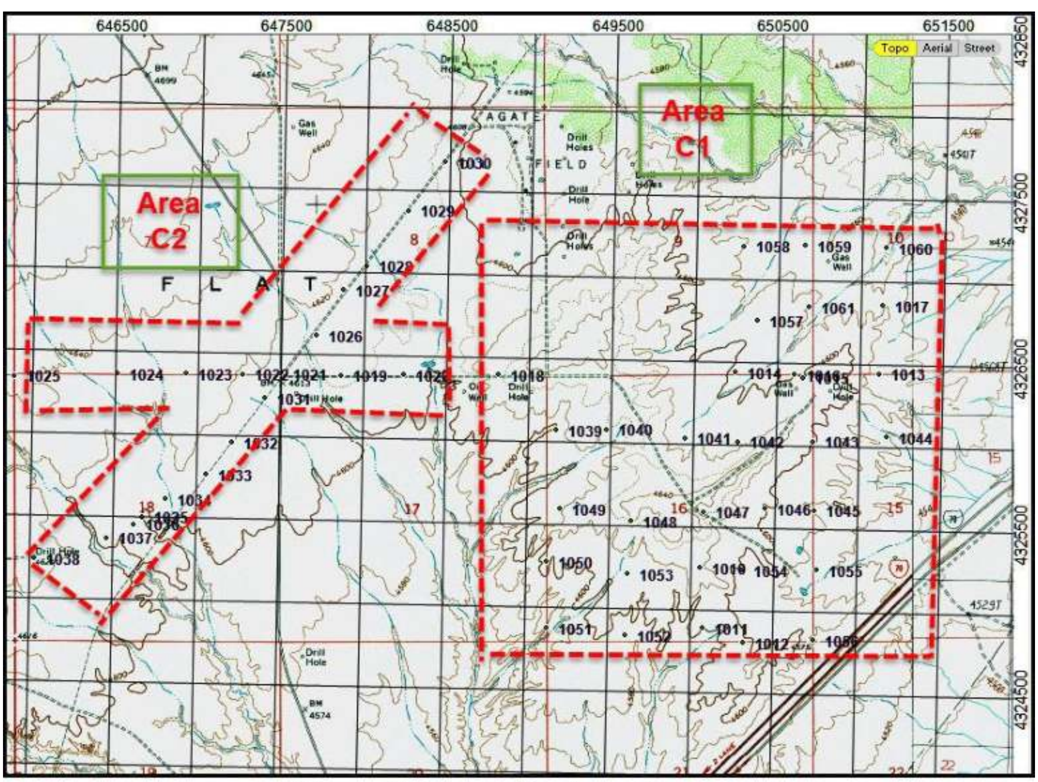


Figure 57. Cisco Springs Area C

Areas C1 and C2

Almost the whole of the C1 area is anomalous with helium and at the 5.5 ppm level four anomalies are indicated (i.e. Helium Prospect #6, Figure 58).This prospect is of medium quality that is open in all directions. The C2+, C1/C2 ratio and pentane anomalies indicate the C1 area is of the light oil, condensate and rich gas variety (Figures 57, 57A and 58-62). However, the contour map of C1/C2 is considered inaccurate because it is based on only 17% of the total samples due to biodegradation of ethane. A CO2 contour map (based on 100% of sample) showing a halo anomaly of light oil and associated hydrocarbons would also indicate a a masking effect of impervious carbonate layer over methane and C2+ anomalies (Figure 62A). (See Annex 6 for a discussion of apical versus halo anomalies)

As in Area B, to obtain a clearer more definitive picture of these anomalies would require infill sampling over the whole area using the pre-drill method to achieve deeper depth. Also, the helium and light oil anomalies should be traced beyond the borders of the geochemical survey project.

In Area C2 three samples contain anomalous helium concentrations: 1028 (5.59 ppm), 1031 (5.76 ppm) and 1035 (5.91 ppm). Area C2 helium and hydrocarbon data could not be contoured because sample points are in a single line and are too far apart from either Area B or C1. Consideration should be given to connecting Area C2 with Areas B and C1.

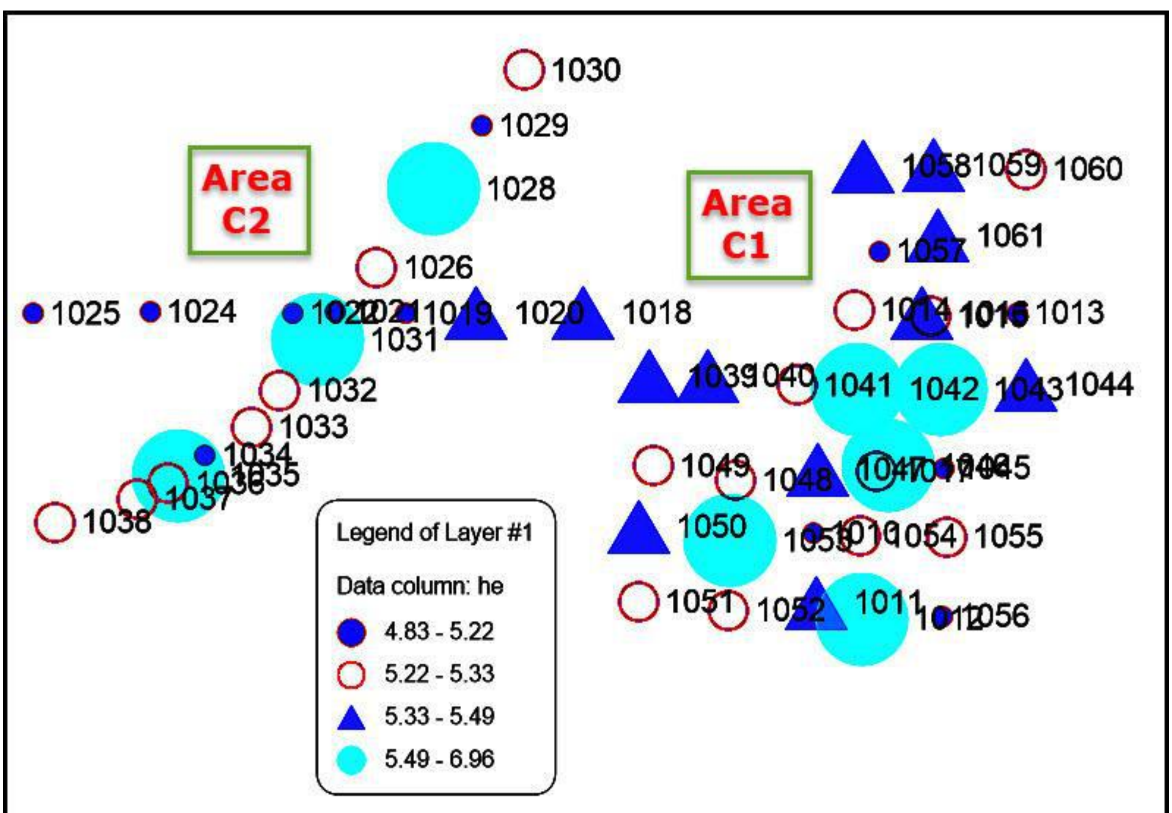


Figure 57A. Cisco helium bubble map Areas C1 andC2

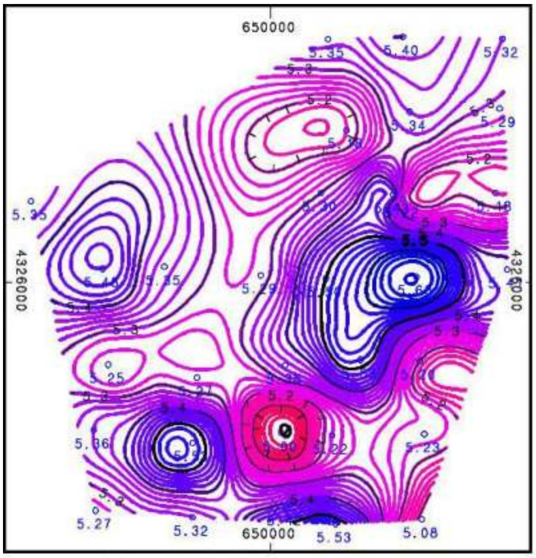


Figure 58. Helium C1 Area

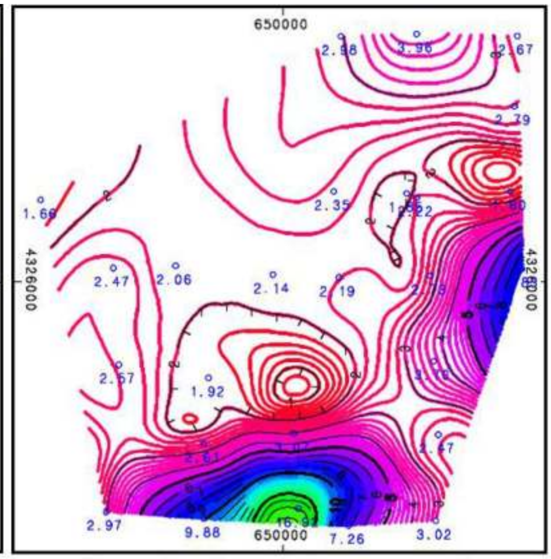


Figure 59. Cisco hydrogen Area C1

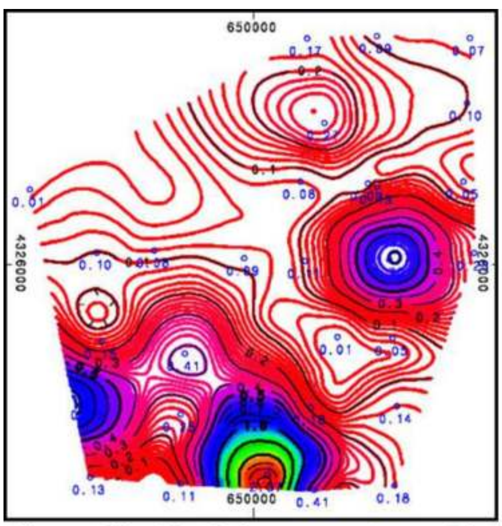


Figure 60. C2+ 0.1 ppm contours C1

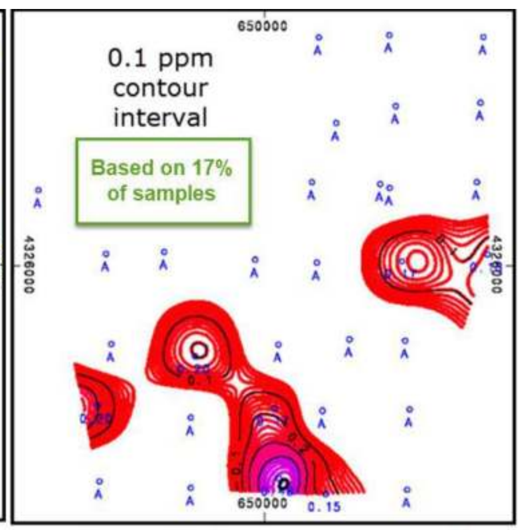


Figure 61. Pentane contours C1

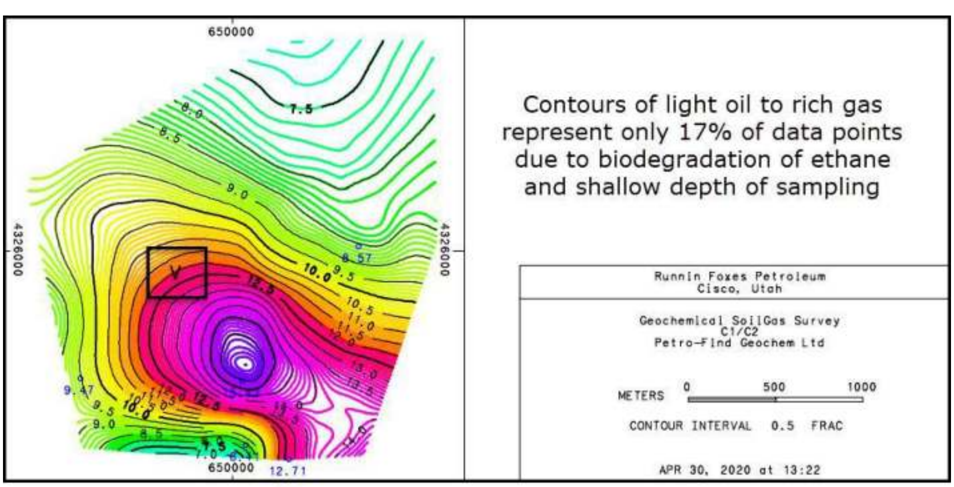


Figure 62. Ratio methane vs ethane Area C1

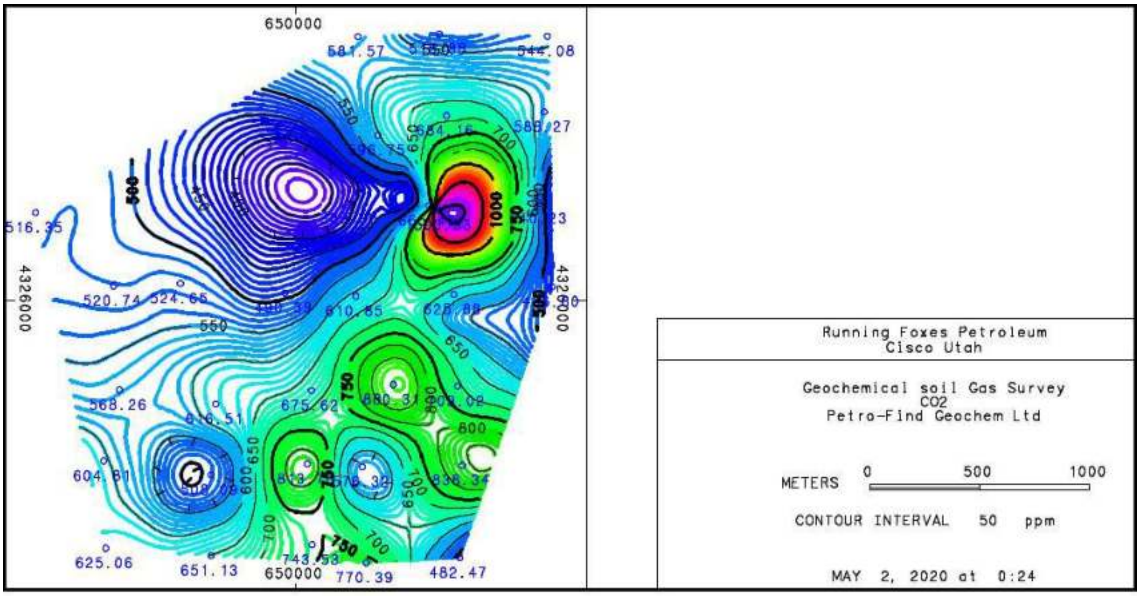


Figure 62 A. CO2 anomaly Area C1

11. Recommendations

1. Enough data has been developed to warrant drilling of the unique Helium Prospect #1 associated with nitrogen in Area B. At the 5.5 ppm helium level this prospect is 421 acres in size and is open to the north, west and south. Seismic should be considered before drilling to confirm the existence of a structural trap deemed to be in the Entrada Formation. Given favourable drilling results geochemical soil gas sampling on a 200 meter high-density spacing is recommended to extend the anomaly in three directions. Options on adjoining leases should be acquired before drilling. Information on the drilling results should be closely held in any case.

2. A sampling program should focus on defining and extending beyond the current survey borders the two highly prospective light oil and associated gas prospects in Area B. Estimates based on hydrogen concentration data place the size of the two prospects from this survey at 1268 and 218 acres.

3. A sampling program is recommended comprising infill on 200 meter spacing and reconnaissance on 400 meter spacing to extend the discovered helium and petroleum anomalies beyond the current survey borders. Particular focus should be placed on connecting Areas A and B.

4. It is recommended that in future geochemical soil gas and seismic surveys the anomalies of helium, heavy oil, and light oil (and associated gases) be correlated with trends in fault/fracture systems. It is well established that fault/fracture sets have been the conduits for charging of both helium and oil reservoirs. The establishment of fairways for each of the targets will increase chances for discovery as well as enhance the potential for helium reservoir development by a clearer understanding of drainage patterns.

5. The potential for discovery of commercial reservoirs of helium and hydrocarbons in Cisco Springs is large but this can only be achieved with good planning that includes timely and appropriate use of seismic, geochemical soil gas surveys, big rig drilling and acquisition of contiguous leases.

12. Statement of Qualifications –Paul Lafleur, PEng

I, Paul Lafleur of 215 Mallin Crescent, Saskatoon, Saskatchewan, S7K7X3, phone number 306-931-3156 do hereby certify that:

I am a graduate Geological Engineer from the Colorado School of Mines and a graduate of the University of Western Ontario. I have had years of experience practicing my Profession as a geologist, engineer and mineral economist. During the last 16 years I have been engaged as a Geological Engineer to conduct geochemical soil gas surveys for oil and gas. I am currently the President of Petro-Find Geochem Ltd of Saskatoon SK. Paul and Ruth Lafleur are the sole owners of the company.

I am a registered Professional Engineer with the:
Association of Professional Engineers & Geoscientists of Saskatchewan (APEGS).

I have been granted permission by The Association of Professional Engineers &Geoscientists of Saskatchewan to offer my services in Saskatchewan as a Consulting Engineer/Geoscientist in the following fields:

Geological Engineering: mineral and energy economics; application of trace hydrocarbon and fixed gas analysis of soil gas to identify and characterize the presence of hydrocarbons and minerals.

The APEGS ***Certificate of Authorization*** for Petro-Find Geochem Ltd is ***C1406***.

13. References

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2. Case, J.E.; Geological map of the Northwestern part of the Uncompahgre Uplift…..; to accompany USGS Map 1-2088; 1991
3. Craddock, H et al; Mantle and Crustal Gases of the Colorado Plateau: Geochemistry, Sources , and migration pathways; Geochemica et Cosmochimica Acta 213 (2017) 346-374
4. Lillis, Paul G; Petroleum Systems of the Uintah and Piceance Basins-Geochemical Characteristics of Oil Types; U.S. Geological Survey, Digital Data Series; 2003
5. Lowenstern, J.B. et al; Prodigious Degassing of a Billion Years of Accumulated Radiogenic Helium at Yellowstone; Nature 19 Feb 2014
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Annual Meeting, Salt Lake City, UT September 22–24, 2013, Search and Discovery Article 90169
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11. Yirka, Bob; Researchers Discover Helium Billions of Years Old Being Released in Yellowstone; Phys Org Feb 20, 2014

14. Annexes

Annex 1. Analytical Data (see ADDENDUM to this report)

Annex 2. Geology of the Colorado Plateau and Uncompahgre Uplift

Northeastern Arizona is part of the Colorado Plateau Physiographic province (Figures 63 and 64). The Colorado Plateau is characterized by flat-lying, relatively undisturbed, largely marine sedimentary rocks of Paleozoic and Mesozoic age that are covered by Tertiary to comparatively recent volcanic flows. The Colorado Plateau was able to preserve its structural integrity and remained a single tectonic block over it entire geological history.

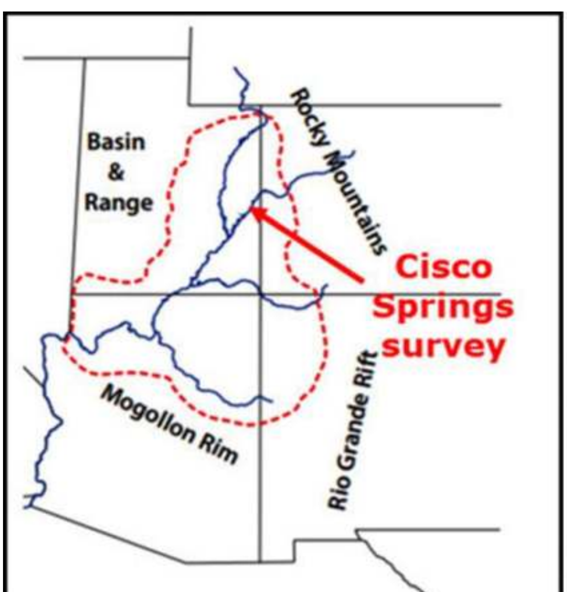

Figure 63. Extent of Colorado Plateau and Tectonic provinces that defines it (Trexler)

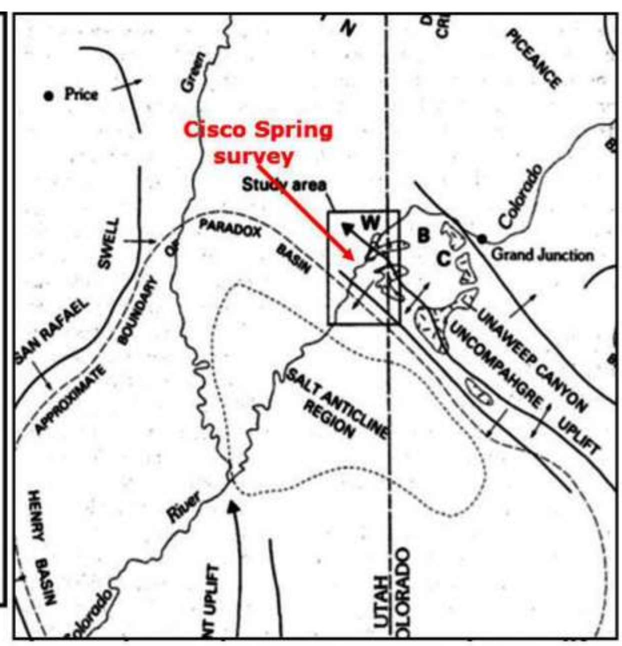

Figure 64. Cisco Spring Survey in Relation to Uncompahgre Uplift (Source: Case)

The following description of structural geology of the Colorado Plateau is paraphrased from the Trexler paper. At the beginning of the Mesozoic era (~265 million years ago), the breakup of the Pangea supercontinent began, separating eastern North America from northwestern Africa and ultimately leading to the initiation of a subduction zone along western North America. During the early Cretaceous period (~140 Ma), the Colorado

Plateau was once again in a shallow marine/coastal terrestrial depositional setting, this time in the Cretaceous Interior Seaway. At around ~70 million years ago (Ma), subduction of the down going Farallon plate beneath western North America shallowed dramatically, causing the deformation belt to migrate eastward. Known as the Laramide orogeny, this event caused widespread uplift, faulting, and folding throughout what is now the interior west of North America, and formed the modern Rocky Mountains. **Though the Colorado Plateau is contained within the region deformed by the Laramide, it remained largely intact.**

At ~40 Ma, the subduction angle of the Farallon slab is thought to have steepened again, causing the compressional deformation responsible for thrust faulting and folding to migrate westward toward the North American coast and bringing an end to Laramide deformation. As a result of the westward retreat of compression, regions of extensional tectonics began to form surrounding the Plateau. In the Rio Grande Rift, a narrow region of modest (10-50% of its initial width) extension southeast of the Plateau, extension initiated at ~32 Ma and continues today. The Basin and Range province, which borders the Plateau to the west and southwest, is over 100 km wide and exhibits much more significant extension (over 100% of its initial width) than the Rio Grande Rift, and initiated later, perhaps around 17 Ma. **Though seemingly surrounded by extensional regions, the Colorado Plateau once again escaped significant internal deformation**.

Structures in the Precambrian and their relevancy to helium exploration are described in the Section on Exploration Principles.

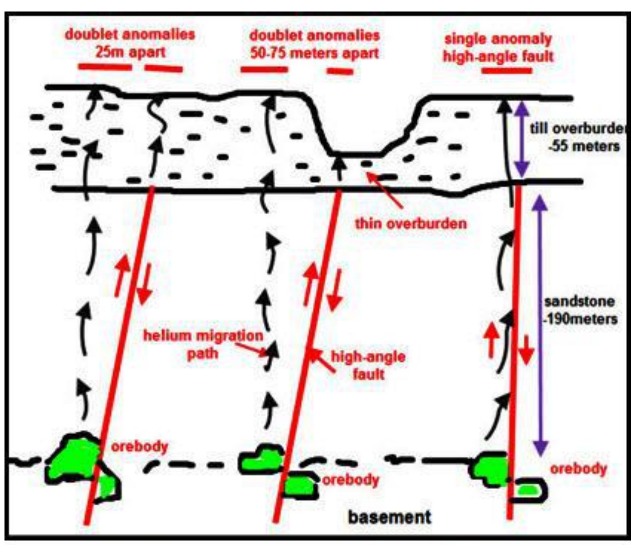

Figure 65. Schematic of helium migration along reverse and normal faults in Precambrian

Annex 3. Uranium Exploration Using Helium and Hydrogen as Pathfinders

Much has been learned about geochemical surveys for helium in the Phanerozoic from uranium exploration using helium as a pathfinder, especially in the methodology. The flow paths are aptly demonstrated in Figure 65 which shows helium from known uranium sources migrating along reverse and normal faults. It should be noted that the surface anomalous patterns over reverse faults are more subdued with aureoles representing helium migrating upward along smaller cracks and fissures. Petro-Find clearly showed over many years that concentrations in soil gas of helium and can be reliably related to underlying uranium deposits if proper sampling and analytical methods were developed. The range of anomalous helium can a reach a max of 10 ppm in soils over high-grade uranium deposits in the Precambrian at 1000 meter depth. The concentration is comparatively low because helium is trapped by the massive uraninite mineralization from which it is produced

Annex 4. Geochemical Depletion Patterns

Dissolved gas reservoirs such as heavy oil deplete very quickly forming doughnut or halo types of anomalies around well heads. Oil fields with water and gas cap drives also show this effect at the surface but because of the uniformity of pressures, the depletion of apical anomalies will be more uniform over a longer period of time.

The pattern of helium anomalies over helium reservoirs that have undergone production or excessive open-bore testing is analogous to the dramatic changes in geochemical patterns over oil reservoirs undergoing development (Figure66). The fact that such C2+ patterns do not revert to their original configuration even after many years provides the basis for revitalization schemes of depleted and abandoned oil and gas fields. In the case of helium reservoirs a geochemical signal may not return for many years, if ever.

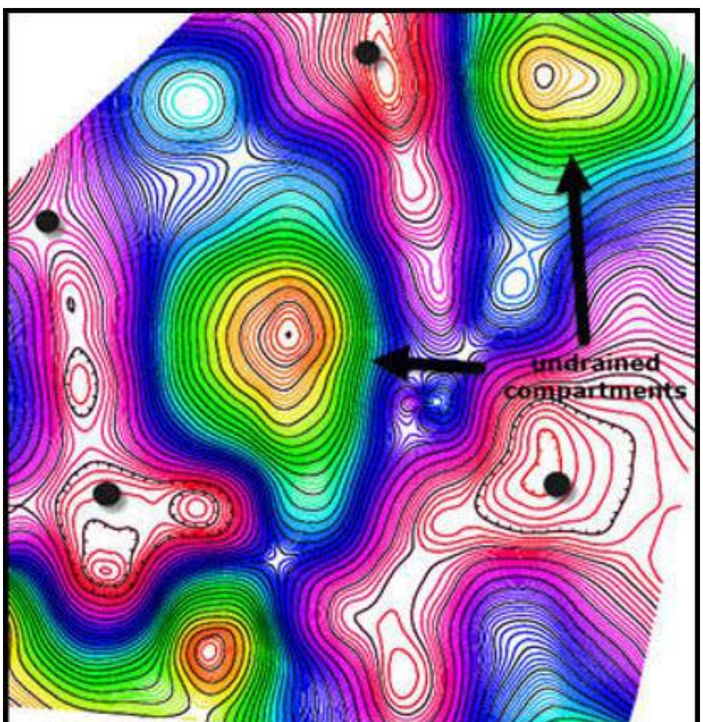

Figure 66. Geochemical Pattern C2+ Over an Oil Reservoir at Early Stage of Development

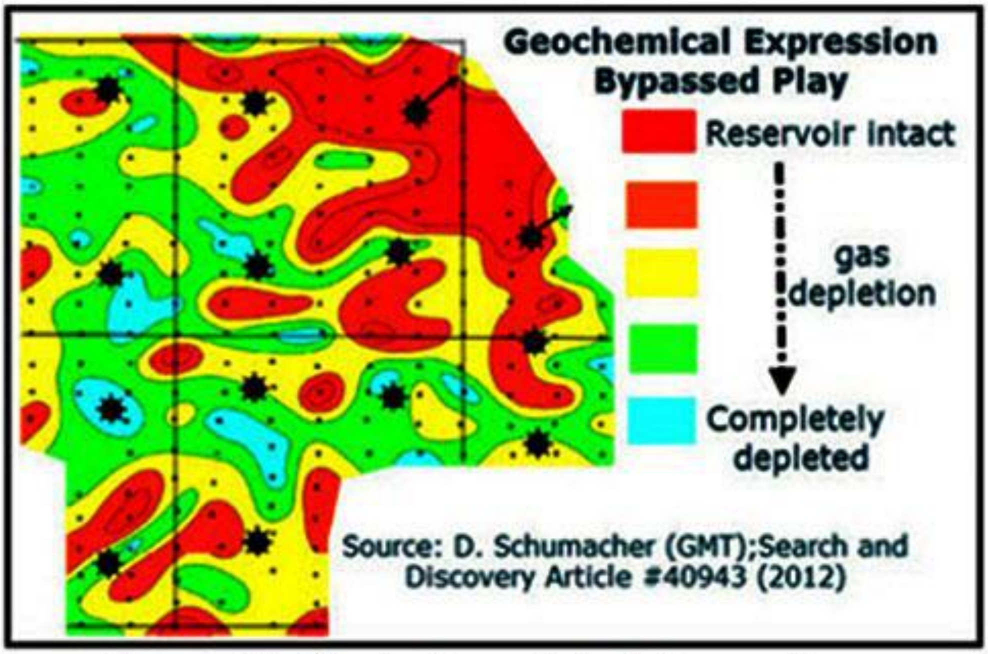

Figure 67. Illustration of depletion patterns over a producing oil field

Geochemical techniques can identify concentration patterns that show undrained portions (i.e. sweet spots), as well as bypassed compartments and optimum edges of pools. Before any drilling, anomalies are usually apical because light hydrocarbons migrate vertically in the direction of lower pressure to the surface. However, once a well begins to produce, the light hydrocarbons are short-circuited horizontally to the well bore or area of lower pressure, thus modifying the original apical anomaly. This is especially the case for heavy oil with dissolved gas that deplete very quickly forming doughnut or halo types of anomalies around well heads. The same pattern is exhibited in geochemical helium anomalies that have been affected by production and excessive testing. In the accompanying diagram of an oil reservoir in the early stages of development, contours of C2+ concentrations show both depleted areas and undrained portions of the field, which represent good targets for drilling (Figure 67).

Annex 5. Harley Dome, Utah

According to **IACX Energy**, in 2013 the company commenced helium production and sales from a new facility located at Harley Dome, Utah, approximately 40 miles west of Grand Junction, Colorado and 13 miles northeast of the Cisco Springs geochemical survey project (Figure 68). This facility is the first helium-only application to extract the rare gas from federal lands and is IACX's third helium plant. The Harley Dome field was discovered in 1925 and was designated "Federal Helium Reserve No. 2" by President Franklin Roosevelt in 1934. Despite the proven nature of the reserve with 7% helium concentration, it remained unexploited because of its low reservoir pressure and association with nitrogen rather than hydrocarbons.

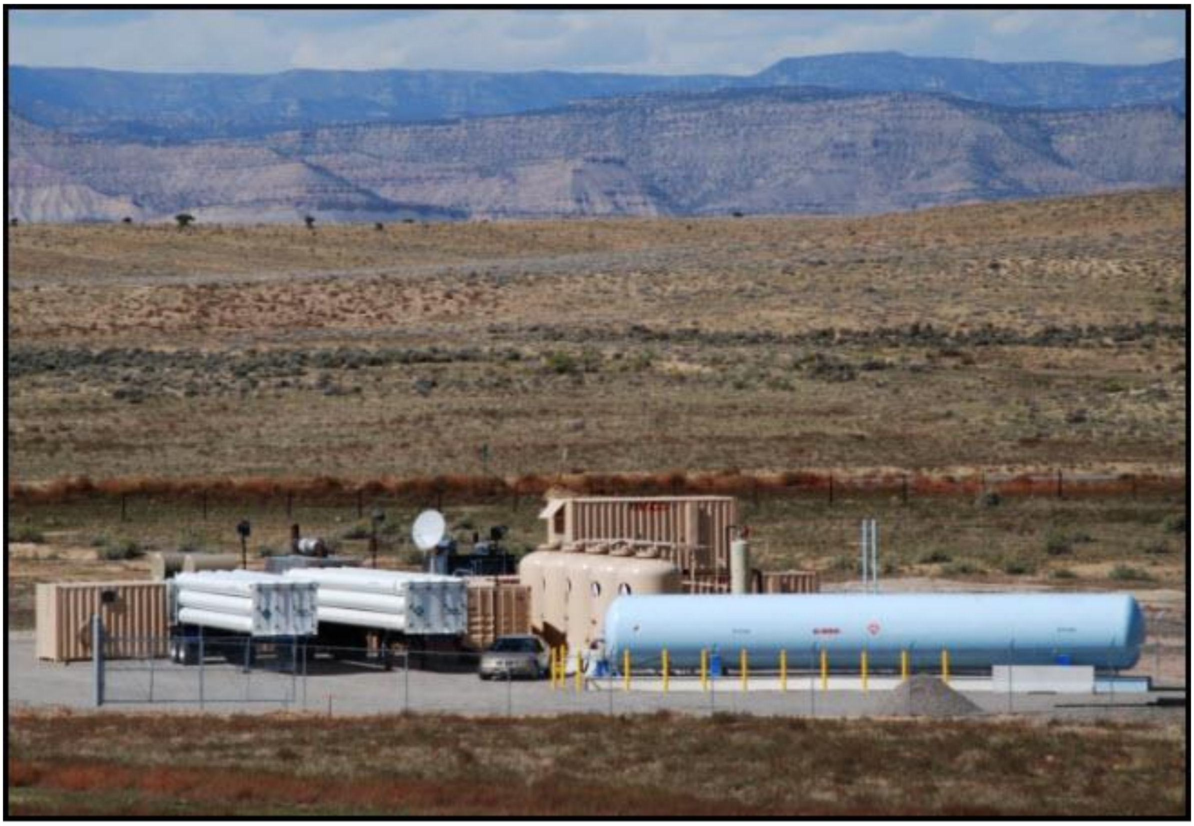

Figure 68. Harley Dome helium extraction plant

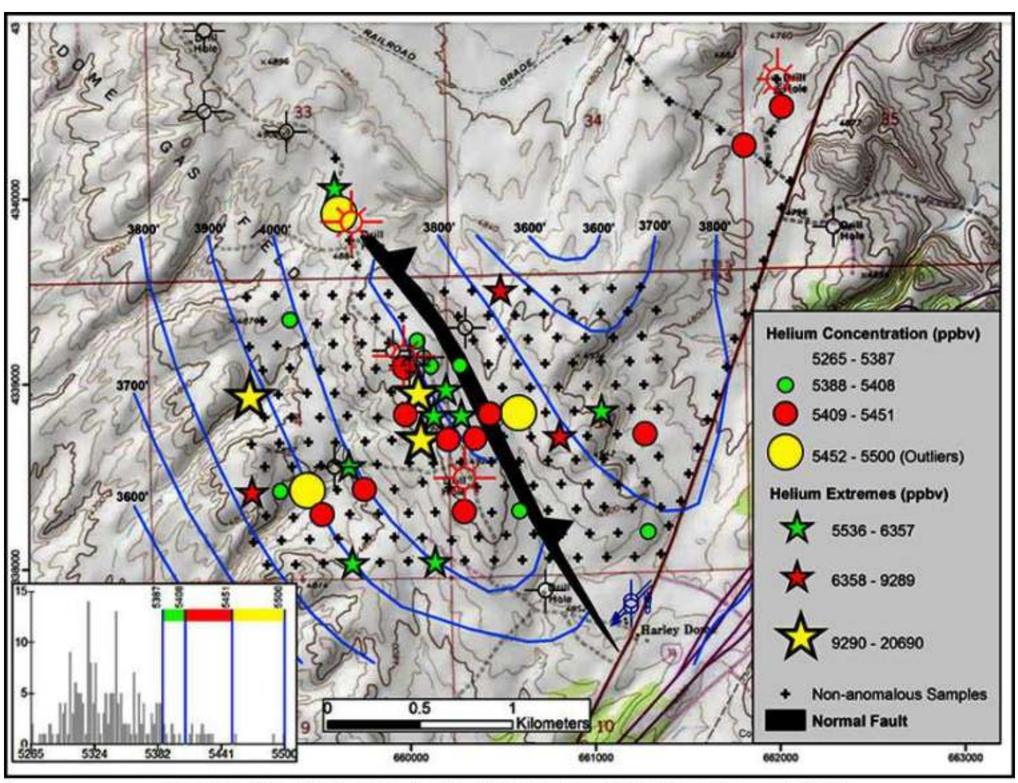

Figure 69. Geochemical survey over Harley Dome Field
Source: ***Geochemical Insight*** Web site

In 2016, ***Geochemical Insight*** reinterpreted and plotted data developed by ***Geofrontiers Corporation*** who had collected and analyzed 1-meter deep soil gas samples at 150 meter intervals over the 1,200-meter deep Entrada Sandstone hosted helium reservoir (Source: ***Geochemical Insight*** website). Several weak to strong helium anomalies were observed directly over the gas field **(**Figure 69**)**. Helium anomalies were also found along northeast trending valleys (faults?) extending up to 700 meters down-dip to the southwest of the field and up to 500 meters northeast of the field on the down-thrown side of the normal fault. Two anomalies were also found within 100 to 300 meters south of a temporarily abandoned gas well in the northern part of the survey area. Although the helium anomalies were somewhat scattered around the Harley Dome gas field, the overall anomaly pattern would have drawn exploration into this area, which would help lower exploration risk (Source: ***Geochemical Insight*** website).

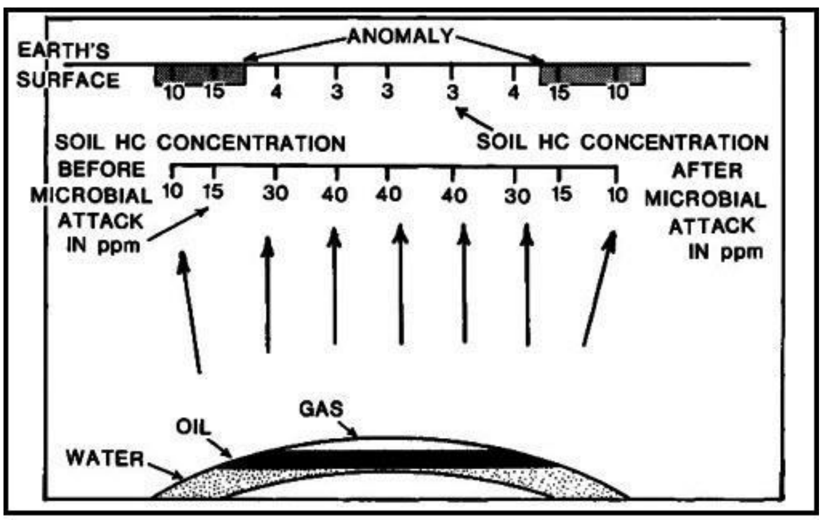

Figure 70. Apical vs halo-type anomalies
Source: USGS Open File Report 85-271

Annex 6. Apical and Halo Hydrocarbon Anomalies

Reservoirs of natural gas (and oil) can exhibit three types of geochemical soil gas anomalies – apical, halo and modified apical. An apical anomaly exists over the reservoir where light hydrocarbons migrate from the reservoir vertically to surface soils. However, apical anomalies may be modified by severe biodegradation which can reduce the size and shape of the anomalies. The halo type appears over reservoirs in certain hot and humid areas where very active aerobic microbes in near-surface soils attack the upwardly migrating hydrocarbons (Figure 70). A typical doughnut shaped anomaly with low methane values in the middle directly over the reservoir with discontinuous high methane concentrations in the periphery.

It is generally accepted that carbon dioxide produced from the biodegraded hydrocarbons reacts with water to produce carbonic acid which in turn reacts with calcium compounds to produce a calcium carbonate barrier. The calcium carbonate (calcite) can occur in soil profiles as caliche in desert environments or as marl in others. The near-surface calcium carbonate can act as a barrier to the upward migration of hydrocarbons except at the edges of the cap where high anomalous methane values can exist. Thus it is important to recognize whether the anomalous patterns are apical, halo or modified apical before undertaking any follow-up seismic or drilling programs. Misinterpretation has led to many dry holes drilled in the high methane anomalous periphery of the halo type.

Four methods can distinguish between petroleum apical, halo (annular) and modified apical anomalies: helium surveys, carbon isotope analysis of calcium carbonate in marl, contours of CO_2 concentrations and biofilms (not present in the Cisco Springs area). If helium is associated with the natural gas in a reservoir it will tend to migrate vertically to the surface producing apical anomalies because it is unaffected chemically. Interpretation of methane anomalies by isotopic analysis of carbon in calcium carbonate (the delta carbonate method) can determine the origin of the carbonate and thus the areal extent and configuration of the reservoir. This method is practised extensively in China who borrowed the technology from USA firms some years ago.

A plot of methane versus CO_2 gives major insight into whether methane anomalies are of the apical, halo or modified apical type. For an apical anomaly regression analysis of methane versus CO_2 data is usually linear but correlation is only moderate if CO_2 is derived from other sources such as biodegradation of the other light alkanes and alkenes as well as root and microbial respiration. A plot of methane versus CO_2 shows no correlation at all for a halo or modified type of anomaly indicating that methane has been severely biodegraded.