Integration of Remotely-Sensed Geobotanical and Structural Methods for Hydrocarbon Exploration in West-Central West Virginia

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1. Analysis of soil gas data of Lewis County

As mentioned in previous quarterly reports, reconnaissance soil gas geochemical surveys were undertaken at the Volcano site on 5/21/96 and 6/17/96, and at the Lewis County (Stonewall Jackson Lake) test site on 10/2/96. The Volcano geochemical data showed a strong correlation between ethane concentration and distance to cross-strike lineaments. In addition, soil gas values were generally correlated with the spectral anomalies identified in the nPDF spectral anomaly image.

The results of the Lewis County geochemical survey are more ambiguous than the Volcano site. This is somewhat to be expected, due to the highly variable pressure in the reservoir. The typical operating pattern is to pressure-up the reservoir over the summer, and then draw it down over the winter. For this reason an October date was chosen for the survey, when pressures are high, and have been high for the longest time. The presence of the spectral geobotanical anomaly in the October imagery suggests that the presence of the gas does affect the overlying vegetation in the fall.

The gas in the reservoir is dominantly methane. Therefore the first step was to overlay the methane data over the spectral anomalies. The methane data have a relatively small range – from 841 to 3,478 parts per billion (ppb). There is no clear association of methane magnitude with either the spectral anomalies or lineaments. In addition, the highest value (3,478 ppb) is found outside the dry-hole perimeter of the reservoir, in an area that does not show evidence of the anomaly. Possibly the small range in the values is part of the problem.

As an alternative to an examination of the absolute values, the ratios of methane to ethane were examined. The aim with this analysis was to highlight areas where the soil gas was characterized by an anomalous amount of methane compared to the other soil gases. The attached map shows the geochemical data, plotted over the spectral anomalies. The lineaments and the boundaries of the two gas reservoirs are also shown. As can be seen from the map, higher values of the ratio are found over the Rhodes reservoir, and are especially concentrated along lineaments. With one exception, all ratio values over 30 are found on or near lineaments that cross the center part of the reservoir. The one exception, a ratio of 57, is found in the center of the main anomalous region, and occurs near a north-south lineament, which was only partially mapped by one of the two lineament interpreters. That lineament was therefore not included in the lineament data shown on the accompanying map. The highest methane to ethane ratio values (greater than 100) are found on the western side of the reservoir, where the spectral anomalies are more rare. The highest value of all, 213, is almost 1 kilometer from the nearest lineament. This area, however, is near the pipeline and injection wells, and may be a local surface contamination problem, rather than the result of microseepage from depth.

2. Presentations and Publications

A poster presentation was made at the FETC Natural Gas Conference in Houston. An abstract was published (Warner, 1997a), and a paper was submitted for the electronic proceedings on CD ROM.

An oral presentation was made at the Association of American Geographers meeting, in Fort Worth, Texas (Warner, 1997b).

In addition, the editors of the Manual of Remote Sensing have requested a short summary of this project for the next edition of this volume. Permission to publish the summary has been requested of FETC.

3. References

Warner, T. A., 1997a. Geobotanical and lineament analysis of Landsat satellite imagery for hydrocarbon microseeps. *Natural Gas Conference*, March 24-27, 1997, Houston, Texas, P-27.

Warner, T. A., 1997. Geobotanical remote sensing of hydrocarbon microseeps in West Virginia. *Abstracts, Association of American Geographers 93rd Annual Meeting, Fort Worth, Texas*, April 1-5, 1997, p 280.

Timothy Warner
May 29, 1997

Geobotanical and Structural Interpretation Map

Landsat Thematic Mapper Satellite Image
Acquired September 20, 1985

Provisional Geobotanical Interpretation
nPDF (1110001) transformation
Gray tone density slice DN 0 - 240
Color tone density slice DN 241 - 255

- ☒ Rhodes Gas Reservoir (Gantz)
- ☒ Skin Creek Reservoir (Gordon)
- ☒ Lineaments

Soil gas ratio: c1/c2

West Virginia University Remote Sensing Laboratory
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