Trace Element Anaomaly and Aspect Analysis

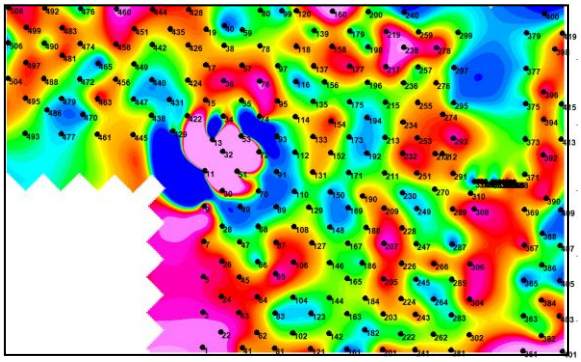

Figure 5: Variation in Copper (Cu) concentration in the studied area.

Strontium concentration ranged between 9.66 and 90.10 ppm with mean value 23.29 ppm. The highest value of Sr concentration is reported in sample no. 49. The cut off value selected for the anomalous strontium (Sr) zone is 44 ppm and above. [Figure-6] The list of samples showing the anomalous behavior in their decreasing trends is 49, 80, 426, 490, 28, 449, 456, 47, 474, 499, 506, 17, 262, 483, 409, 59, 463, 401, 13, 481 and 40.

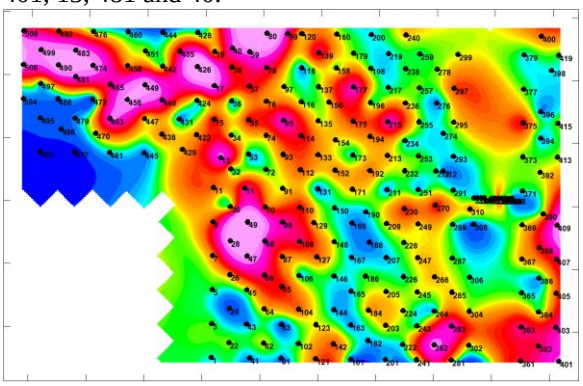

Figure 6: Variation in Strontium (Sr) concentration in the studied area.

Barium concentration ranged between 86.80 and 433.13 ppm with mean value 178.92 ppm. The highest value of Ba concentration is reported in sample no. 463. The cut off value selected for the anomalous barium (Ba) zone is 286 ppm and above. [Figure-7] The samples showing the anomalous behavior in their decreasing trends are 463, 9, 215, 481, 483, 401, 474, 456, 499, 78, 449,142, 28, 361, 426, 177, 508, 492 and 262.

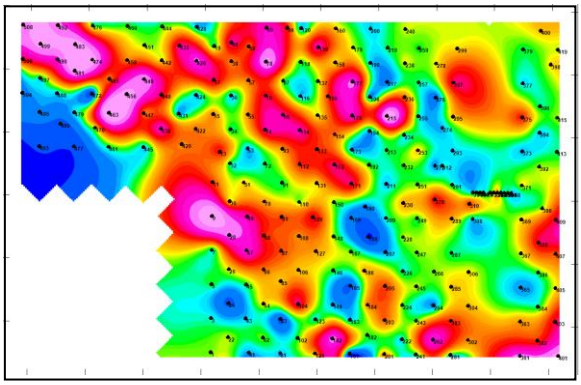

Figure 7: Variation in Barium (Ba) concentration in the studied area.

This increased concentration of trace metals, suggests the chemical change that the soil has under gone in a reducing environment, presumably due to the influence of hydrocarbon micro-seepage (Tedesco, 1995). Pertaining to the contributor model developed using aspect analysis, contributor 2 and 3 follows negative correlation group inferring that Zn-Cu and Ba–Sr have strong correlations which is well corroborating with our numerical data. The sample bearing anomalies defined with Zn-Cu correlation are 9, 32, 361 and 401. The sample bearing anomalies demarcated with Ba-Sr correlation are 28, 262, 401, 426, 449, 456, 463, 474, 481, 483 and 499.

2.Trace Element Manganese (Mn), Vanadium (V), Nickel (Ni), Chromium (Cr) and Scandium (Sc)

Manganese concentration ranged between 21.67 and 1395.85 ppm with mean value 180.25 ppm. The mean value is less than the average value of nearby area which is in the range of 288-817 ppm. The highest value of Mn concentration is reported in sample no. 9. The cut off value selected for the anomalous manganese (Mn) zone is 375 ppm and above. [Figure-8] The samples showing the anomalous behavior in their decreasing trends are 9, 78, 74, 62, 205, 219, 401, 274, 426, 413, 175 and 17.

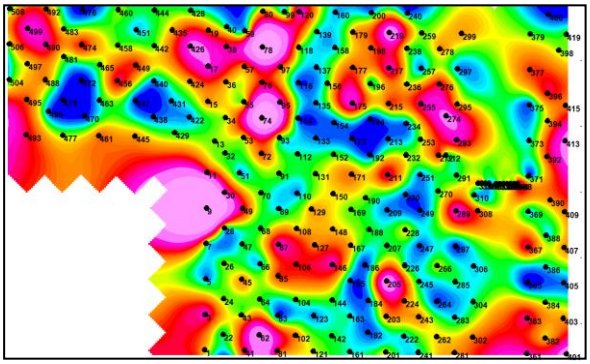

Figure 8: Variation in Manganese (Mn) concentration in the studied area.

Vanadium concentration stretched between 6.33 and 118.84 ppm with average concentration of 58.61 ppm. The highest value of V concentration is reported in sample no. 401. The cut off value selected for the anomalous vanadium (V) zone is 85 ppm and above. [Figure-9] The samples showing the anomalous behavior in their decreasing trends are 401, 226, 361, 367, 481, 106, 438, 74, 492, 217, 30, 1, 26, 483, 76, 463, 428, 177, 154, 36, 9, 205, 85 and 201.

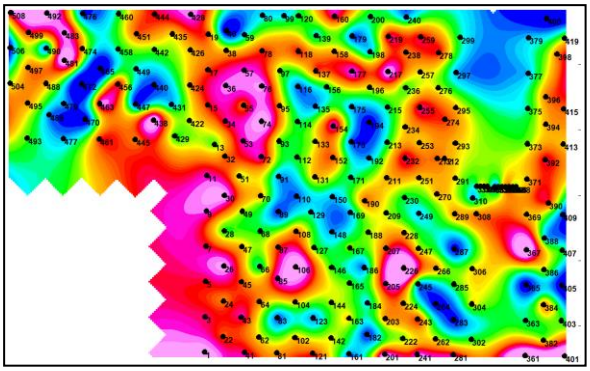

Figure 9: Variation in Vanadium (V) concentration in the studied area.

Nickel concentration varied between 1.56 and 90.24 ppm with mean value of 21.03 ppm. The mean value is less than the average value of nearby area which is in the range of 14.7-80.7 ppm. The uppermost value of Ni is reported in sample no.361. The threshold value selected for the anomalous Nickel sample is 35 ppm and above. [Figure-10] The samples showing the anomalous behavior in their decreasing trends are 361, 481, 492,367, 483, 1, 348, 394, 106, 26, 9, 30, 350, 76, 36, 321, 342, 34, 74, 72, 428, 43, 217, 85, 360, 392, 57 and 118

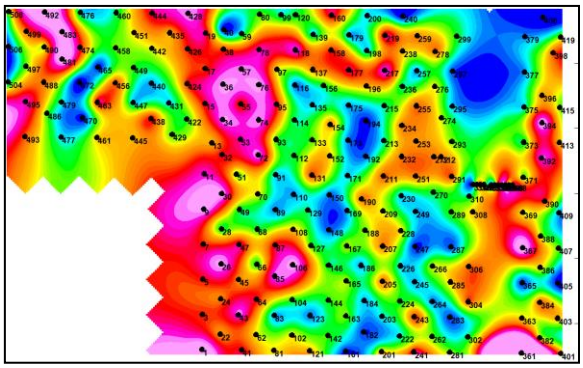

Figure 10: Variation in Nickel (Ni) concentration in the studied area.

Chromium concentration was having minima of 4.30 and maxima of 450.96 ppm, so, the average value comes to 45.75 ppm. The mean value is less than the average value of nearby area which is in the range of 9.03-122 ppm. The highest value of Cr concentration is reported in sample no. 160. The cut off value selected for the anomalous chromium (Cr) zone is 109 ppm and above. [Figure-11] The samples showing the anomalous behavior in their decreasing trends are 160, 142, 9, 114, 158, 121, 226, 201, 361, 76 and 108.

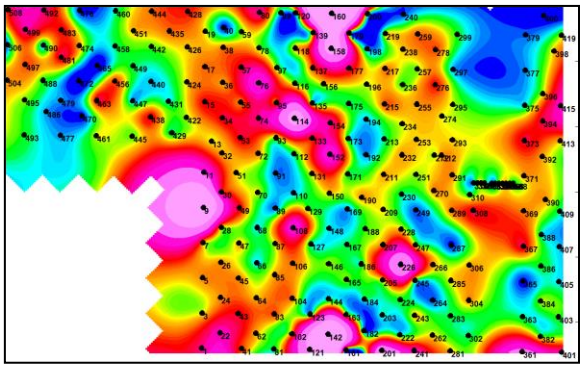

Figure 11: Variation in Chromium (Cr) concentration in the studied area.

Scandium has numerical low of 1 ppm and high of 14.61 ppm with average of 6.7 ppm. The highest value of Sc concentration is reported in sample no.

492. The cut off value selected for the anomalous scandium (Sc) zone is 10 ppm and above. [Figure-12] The samples showing the anomalous behavior in their decreasing trends are 492, 481, 361, 154, 463, 367, 76, 106, 278, 74, 26, 438, 72, 219, 201, 1, 30, 34, 55 and 3.

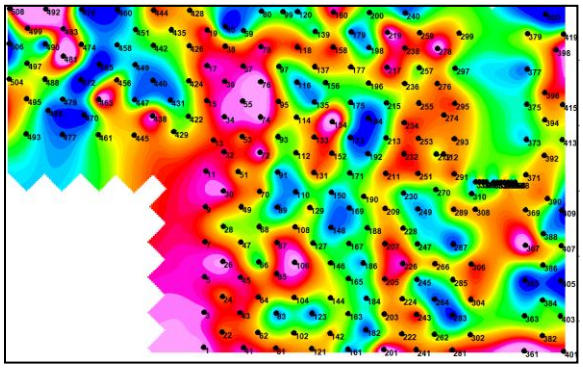

Figure 12: Variation in Scandium (Sc) concentration in the studied area.

Mn-V-Ni-Cr-Sc expressed very strong positive correlation with each other and Sc- V has highest correlation coefficient among the above correlation. Thus, the anomaly based on the above stated model having positive anomaly appears in 1, 26, 30, 74, 76, 106, 154, 201, 361, 367, 438, 463, 481 and 492.

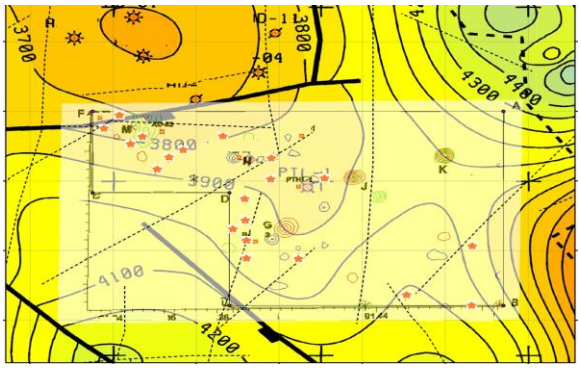

Figure 13: Trace elemental anomalies with Geological settings in the studied area.

When the trace anomaly data was overlayed on geological settings of the area, the acidic pH and the anomalies defined using aspect analysis were well corroborated with the major faults in the area. This confirms the validation of the study.

Conclusion

The average concentration of studied trace elements were Zn: 32.83 ppm, Mn: 180.25 ppm, V: 58.61 ppm, Ni: 21.03 ppm, Cu: 14.14 ppm, Cr: 45.75 ppm, Co: 8.90 ppm, Sr: 23.29 ppm, Sc: 6.7 ppm and Ba: 178.92 ppm.

Aspect analysis allowed us to establish four contributors, C1 to C4 that justifies 63.29 % of data variability. The association of the four contributor model is: C1: Mn-V-Ni-Cr-Sc (positive correlation); C2: Sr- Ba (Negative correlation); C3: Zn- Cu (Negative correlation); C4: Co (Positive correlation).

In this model, contributor one i.e C1 can be further sub divided on the basis of its correlation coefficients as V-Ni has correlation coefficient as 0.820, Sc- V has correlation coefficient of 0.908 and Sc- Ni has correlation coefficient as 0.795, which infer Sc-V > V-Ni > Sc-Ni as the order for strong to good positive correlation.

Pertaining to the contributor model developed using aspect analysis, contributor 2 and 3 follow negative correlation inferring that Zn-Cu and Ba–Sr have strong correlations which is well corroborating with our numerical data. The sample bearing anomalies defined with Zn-Cu correlation are 9, 32, 361 and 401. The sample bearing anomalies demarcated with Ba-Sr correlation are 28, 262, 401, 426, 449, 456, 463, 474, 481, 483 and 499.

Mn-V-Ni-Cr-Sc expressed very strong positive correlation with each other and Sc- V has highest correlation coefficient among the above correlation. Thus, the anomaly based on the above stated model having positive anomaly appears in 1, 26, 30, 74, 76, 106, 154, 201, 361, 367, 438, 463, 481 and 492.

The overall anomalies based on negative and positive correlation of trace metal anomalies are 1, 9, 26, 28, 30, 32, 74, 76, 106, 154, 201, 262, 361, 367, 401, 426, 438, 449, 456, 463, 474, 481, 483, 492 and 499. The increase in the concentrations of trace metals, suggests a soil chemical change to a reducing environment, presumably due to the influence of hydrocarbon micro-seepage. Enrichment of trace elements seen around the hydrocarbon anomaly helps

to verify the correlation between micro-seepage and trace element concentrations. This methodology may be further integrated with other geo-scientific studies for identification of hydrocarbon potential of the area. The enrichment of trace elements around the hydrocarbon anomalies suggests that trace elements can be a pathfinder for hydrocarbon micro-seepage.

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