

# Geochemical Exploration New Solution to an Old Problem: Identification of Gold Mineralized Zones

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**Abstract:-** Veins and pegmatite are suitable carriers for the mineralization of several elements such as Au(gold), Silver(Ag), Cu( copper) etc. in this paper we will discuss the REE and Gold mineralization in the korukonda area nearby to Rajahmundry, Andhra Pradesh. Here pegmatite was the rich source of REE, Graphite and quartz vein intruded within the Migmatite gneiss could be a potential source of Au(Gold). The values of Rare Earth Elements (REE) from Lanthanum (La) to Lutetium (Lu) are exclusively higher concentration in the eastern and North-eastern parts of the area, The value of LREE Ranges from 143.25 ppm to 2042.75 ppm, and HREE ranges from 9.09 to 27.37 ppm. the maximum value of Au(gold) observed is around 47 ppb in stream sediments which indicates moderate enrichment of Au (Gold) in the study area .

**Keywords:-** REE (Rare Earth Elements ), Rajahmundry, Migmatite , Veins, Pegmatite, Ppm(Parts Per Million), Ppb(Parts Per Billion)

## I. INTRODUCTION

The area is bounded by latitude N 17° 00' 00" to 17° 15' 00" and longitude 81° 45' 00" to 82° 00' 00" E. covers the upland area North of Godavari delta in East Godavari District of Andhra Pradesh. It is well connected by a metalled road. The higher values of LREE are recorded over pegmatites intruded within Manganiferous (Migmatite) gneiss, at the contact of Basalt & Tirupathi Sandstone and garnet-sillimanite gneiss in the area. It varies from 143.25 ppm to 2042.75 ppm with median values of 643.26 ppm. The threshold values for LREE is 1195.39, whereas HREE is varies from 9.09 ppm to 27.37 ppm with median values of 16.87 ppm. The threshold values for HREEs is 23.08. The elevated values obtained might be due to the weathering and leaching of Pegmatite and gneisses in the area. The higher concentrations of REE suggesting that gneisses and Pegmatite are the source rocks for REE. It is observed that LREE content is comparatively more than the HREE. Gold(Au), Tellurium (Te), selenium(Se), Bi(Bismuth), Antimony(Sb) and Silver show moderate level of enrichment, which indicates that gold and silver might be available in the pegmatite and quartz vein in form of selenides and tellurides

## II. GEOLOGY OF THE STUDY AREA

The area is occupied by the rocks of Khondalite, Charnockite and Migmatites Groups of Eastern Ghats Supergroup in the north, overlain by Tirupathi Formation of East Coast / Gondwana of Gondwana Supergroup, Deccan Trap, Rajahmundry Sandstone towards southern part and Krishna-Godavari Formation towards southwest The Khondalite Group is represented by khondalite, which occupies the northern part of the area. Khondalite is observed around Mellisala, Gopalpuram and Tirumalayyapalem. It is chiefly of garnet-sillimanite + graphite gneiss and contains a few thin impersistent bands of quartzite at places. Intermediate charnockite and hypersthene granite/acid charnockite comprising the charnockite Group occur as minor bodies. The Migmatite Group is made up of garnetiferous quartzo feldspathic gneiss and manganiferous quartzo-feldspathic rocks which are derived from the former due influx of quartzo feldspathic injections and observed near Rajavaram, korukonda and Srirangapatam.

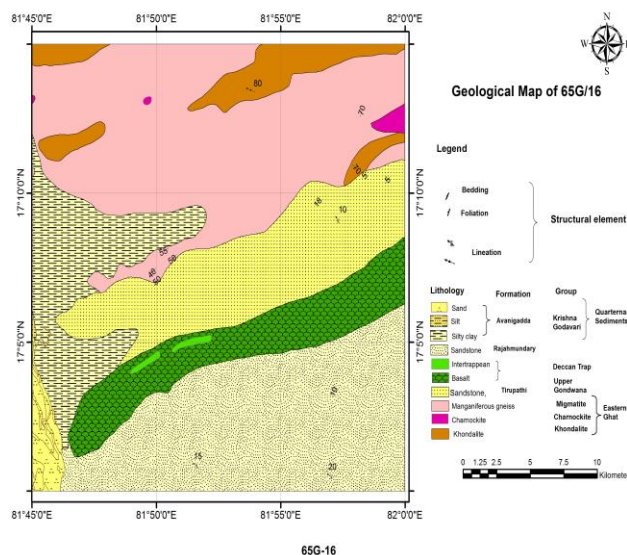


Fig 1: Geological Map of Study Area ( Source : Geological survey of India )

### III. MATERIAL & METHOD

194 Soil samples were collected as per the NGCM program of the Geological survey of India field season 2018-19, Chemical Analysis of the Sample was done by the Chemical Division, Southern Region Hyderabad 500068. Spatial Analytical techniques were used to prepare the geochemical distribution of elements of elements and the environment for Spatial and statistical Analysis was GIS

#### A. Statistical Methods

##### ➤ Univariate Statistical Analysis

The univariate analysis explores each variable in a data set, separately. It looks at the range of values, as well as the central tendency of the values. It describes the pattern of response to the variable. It describes each variable on its own. Univariate analysis commonly involves reporting measures of central tendency. This involves describing the way in which quantitative data tend to cluster around some value. In univariate analysis, the measure of central tendency is an average of a set of measurements, the word "average" is variously construed as (arithmetic) mean, median, mode, or another measure of location. The descriptive statistics function of MS Excel was used to find the univariate statistic containing the number of samples or count (n), minimum value, maximum value, mean, median, mode, standard deviation, and skewness. The mean, median, and mode values are compared to have a theoretical assessment of the normality in the distribution of elements. In case, skewness was found to be high, histograms were prepared for those elements, using geostatistical values

##### ➤ Bi-variant Statistics

The bivariate analysis involves the analysis of two variables (often denoted as X, Y), for the purpose of determining the empirical relationship between them. In order to see if the variables are related to one another, it is common to measure how those two variables simultaneously change together. Common forms of bivariate analysis involve creating a percentage table or a scatter plot graph and computing a simple correlation coefficient. The correlation matrix is prepared by using the correlation function of MS Excel

The software used for the analysis is MS-EXCEL and Arc GIS. The statistical table for each element is attached with their respective elemental distribution maps. The term univariate statistics is commonly used in statistics to distinguish a distribution of one variable from a distribution of several variables. Univariate analysis is commonly used in the first stage of analysis of the data at hand, which include descriptive statistics, histogram, and box plot.

##### ➤ Inverse Distance Weighting (IDW)

It is a type of deterministic method for multivariate interpolation with a known scattered set of points. The assigned values to unknown points are calculated with a weighted average of the values available at the known points. The name given to this type of methods was motivated by the weighted average applied, since it resorts to the inverse of the distance to each known point ("amount of proximity") when

assigning weights. The advantage of IDW-generated interpolated raster surface is exactly restricted to lowest & highest values, but statistically generated kriging surface is restricted to the values which are above the available lowest values and much below the actual highest values. Therefore, anomaly zone/threshold values generated by box plot sometime do not fall within the limit of Krigging surface

### IV. RESULT & DISCUSSION

**Gold (Au), Bismuth(Bi) and Antimony (Sb):** values of gold, Bismuth and Antimony are quite encouraging in the chemical result of stream sediment highest value of gold observed nearby Kolavacherla and Thima Puram which is around **0.05 ppm** due to sieving process by 120 mesh sieve. The value of gold diminished. The higher value of gold observed over the pegmatite and quartz veins of migmatite gneiss group of eastern ghat super group and at the contact of Deccan basalt and Tirupathi sandstone. Same way the value of Bi and Sb anomalous values fall around the Kolavacherla and its surrounding which indicate that the area around the Kolavacherla and its surrounding have the potential for gold mineralization

**Silver (Ag):** silver values of stream sediments and slope wash shows moderate enrichment in the area since the samples were sieved by the 120 mesh size sieve the values got diminished. The highest value of Ag observed was **0.17 ppm** which shows around 3 times enriched then the continental crust over the quartz and pegmatite veins of Migmatite group of rocks and laterite of Rajahmundry sandstone

#### Rare Earth Element (REE)

**LREE:** The higher values of LREE are observed over Manganiferous gneiss and garnet sillimanite gneiss in the area. It varies from minimum value 143 ppm to maximum value is 2042 ppm with median values of 643.26. The threshold values for LREE is 1195.39 ppm. The elevated values obtained might be due to the weathering and leaching of Pegmatite and gneisses in the area. The higher concentrations of REE over lithology suggesting that gneisses and Pegmatite are the source rocks for REE, which is evident from the analytical results and elemental distribution maps

**HRRE:** HREE varies from minimum value 9.09 ppm to maximum value is 23.37 ppm with median values of 16.87 ppm. The threshold values for HREE is 23.08 ppm. It was observed that LREE content is comparatively more than the HREE content which may be due to low concentration of high field strength elements (HFSE) in Pegmatite and gneisses present in the area.





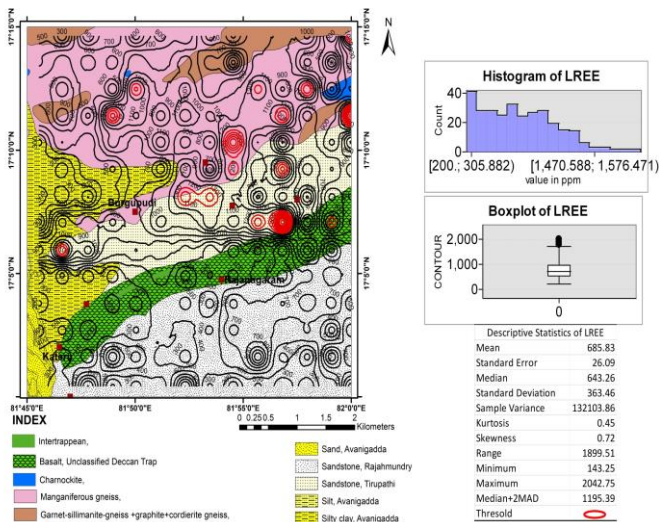


Fig 3: Geochemical map of Light Rare Earth Elements (LREE) over the Lithology map of the study area

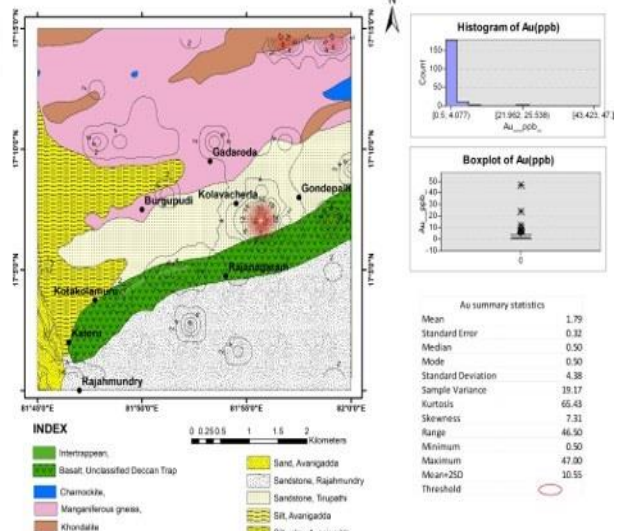


Fig 6: Geochemical map of Gold (Au) over the Lithology map of the study area

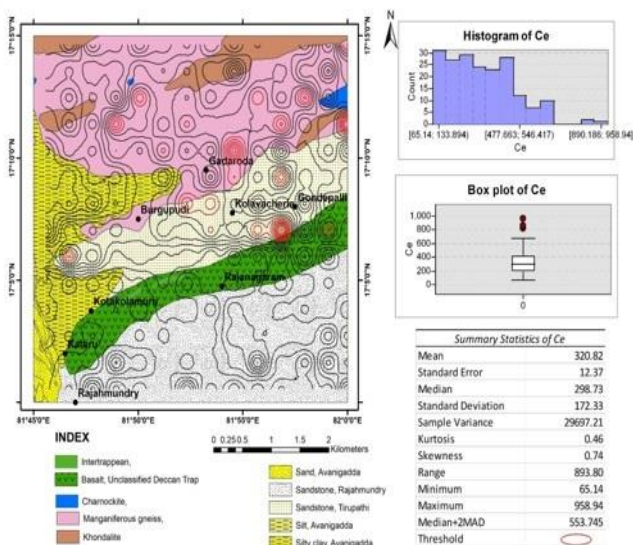


Fig 4: Geochemical map of Cerium (Ce) over the Lithology map of the study area

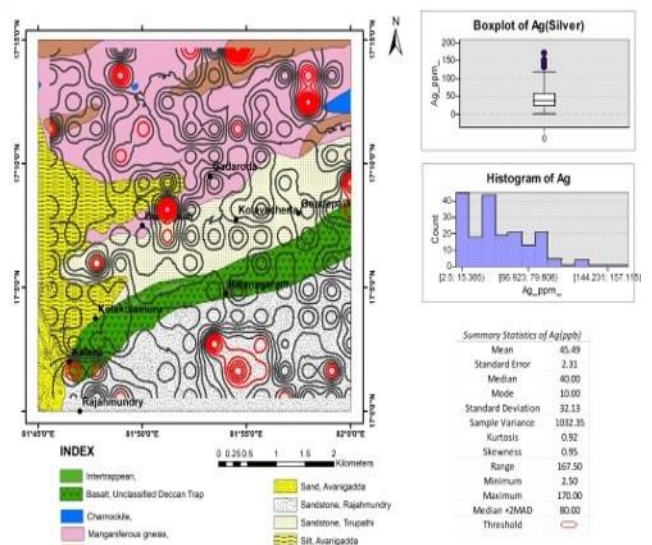


Fig 7: Geochemical map of Silver (Ag) over the Lithology map of the study area.

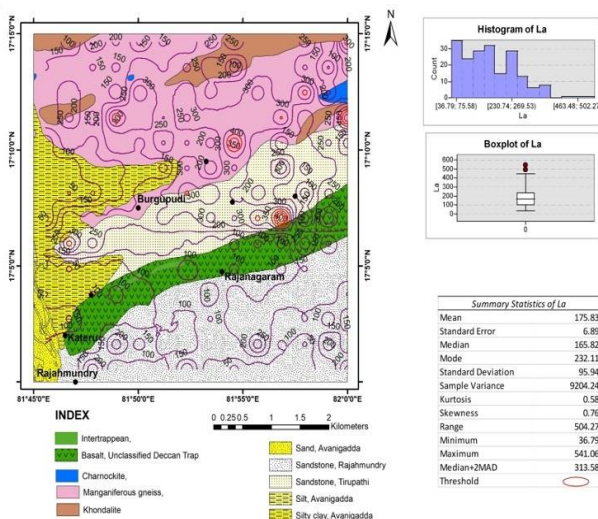


Fig 5: Geochemical map of Lanthanum (La) over the Lithology map of the study area

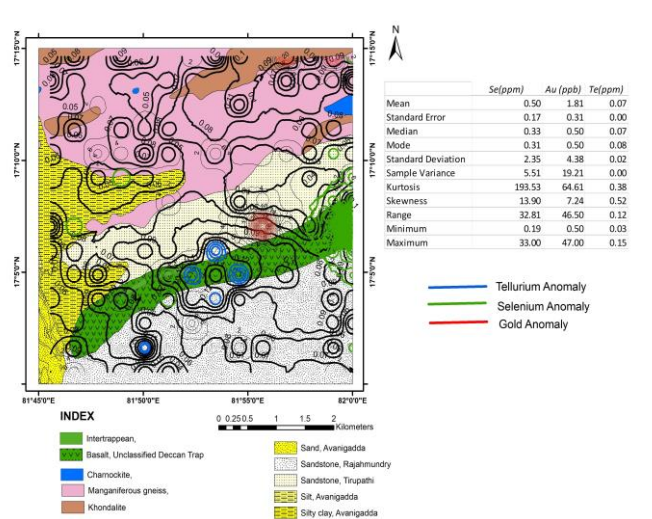


Fig 8: Anomalous zones of Au(gold), Se(selenium) and Te(tellurium) over the Lithology map of the study area

## V. CONCLUSION

By the use of statistical methods and spatial analysis techniques of GIS several inferences were made regarding the elemental enrichment in the study area. anomalous zone of gold(Au) found over the migmatite group of rocks which were profusely intruded by the pegmatites and quartz veins. values of selenium are also very high in the soil samples this also indicate that gold might be present in the quartz veins as selenides or tellurides

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