Exploration of Quartz, feldsphar and Mica Minerals using Geophysical Resistivity, Self-Potential and Natural Electrical Field Techniques

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Abstract
The aim of the present study is to examine various modeling and self-potential techniques which are useful for the exploitation of shallow and deep deposits. v-shaped formation was formed as the geological formation of ore anomaly. The study area indicates the presence of quartz, feldsphar and negative values are associated with the mica group of mineral. The Nellore schist belt is majorly dominated by the schistose group of rocks. The average depth of the mineral deposits occurred in less than 150 ft. This study would be helpful for various arenas.

Keywords: Self-potential graphs, Natural electrical fields graphs, Quartz, Feldspar, Mica, Minerals.

Introduction

Exploration means to search for ore deposits below subsurface of the ground. Geophysical methods, especially self-potential and vertical electrical sound, play an important role to find the ore deposits. Among geophysical method, self-potential and sounding techniques are widely employed[1,24].

Since it uses measurements of naturally occurring potential differences caused by electrochemical, electrokinetic and thermoelectric fields in the earth's subsurface, the self-potential (SP) technique is passive. Fox[3] introduced the SP technique for subsurface research at the beginning of the 1800s. The technique was first applied to understand the potential for mineralization, mostly related to sulphide ore bodies, which was described by oxidation potential and electrochemical mechanism[9,11-13].

When ores or hidden metals come into touch with rocks, groundwater, or rock fluids, electrochemical reactions, including reductions and oxidations, take place that result in the generation of self-potentials. Self-potentials are always characterised by a core negative anomaly and long-term stability[2,15]. "Redox potentials", based on static contacts and are typically more than 40 mV to 200 mV.

Since its discovery, the SP method has been widely applied in a wide range of geophysical applications including engineering and environmental applications, well logging, geothermal exploration, mineral exploration, hydrogeological investigations[8,14] etc. The present analysis reveals the self-potential technique in the quartz, feldspar and mica group of mineral along the Nellore schist belt area.

Study area

The study area was located nearby Gudur town and it is in Tirupathi district of Andhra Pradesh State, India. It belongs to the Andhra region. It is located about 12 km towards west direction i.e. from West Gudur town[7]. It receives the rainfall during the month of November and December and contains the semi-arid type of climate.

Geology of the study area: The geology of the study area was predominately occupied such as Hornblende chlorite schist, quartzite's, gneisses, granite gneisses, gneisses granitoid complex, peninsular gneissic complex, calc-silicate rocks and uncosolidated alluvial clay. Major part of the study area was covered with peninsular gneissic complex. It is a womb of minerals like quartz, feldspar, mica, beryl and tourmaline.

Physiography: The southwestern part of the study area has an altitude ranging between 0 to 50 meters above the mean sea level (MSL) whereas the central, western, eastern and the northern parts have low altitudes. In the study area, hillocks were confined to southwestern parts and the remaining was covered by moderately slope to gentle slope categories. Among Gudur region, the current study area is moderate slope to plain land.

Material and Methods

The present study area was widely used in two types of methods. One is the self-potential and second is vertical electrical sounding (natural electromagnetic difference). Fig. 1 explains the anomaly.

Results and Discussion

In the overall study area, 12 sp surveys were conducted and 20 to 40 VES (natural electromagnetic difference) data were captured and processed in different softwares to produce the graphs. In these graphs, where the bell-type cures express the anomaly like quartz, which starts with 30 to 50mv value whereas the remaining feldspar shows 50 to 80mv values. Mica indicate negative values like -10 and -30mv. The study area majorly contains schist rocks having low self-potential values. Quartz, feldspars and mica were not formed continuously; they were formed like pocket types. In this result analysis, two techniques are portrayed[6]: 1) Self-potential method and 2) Natural electrical sounding method[10].

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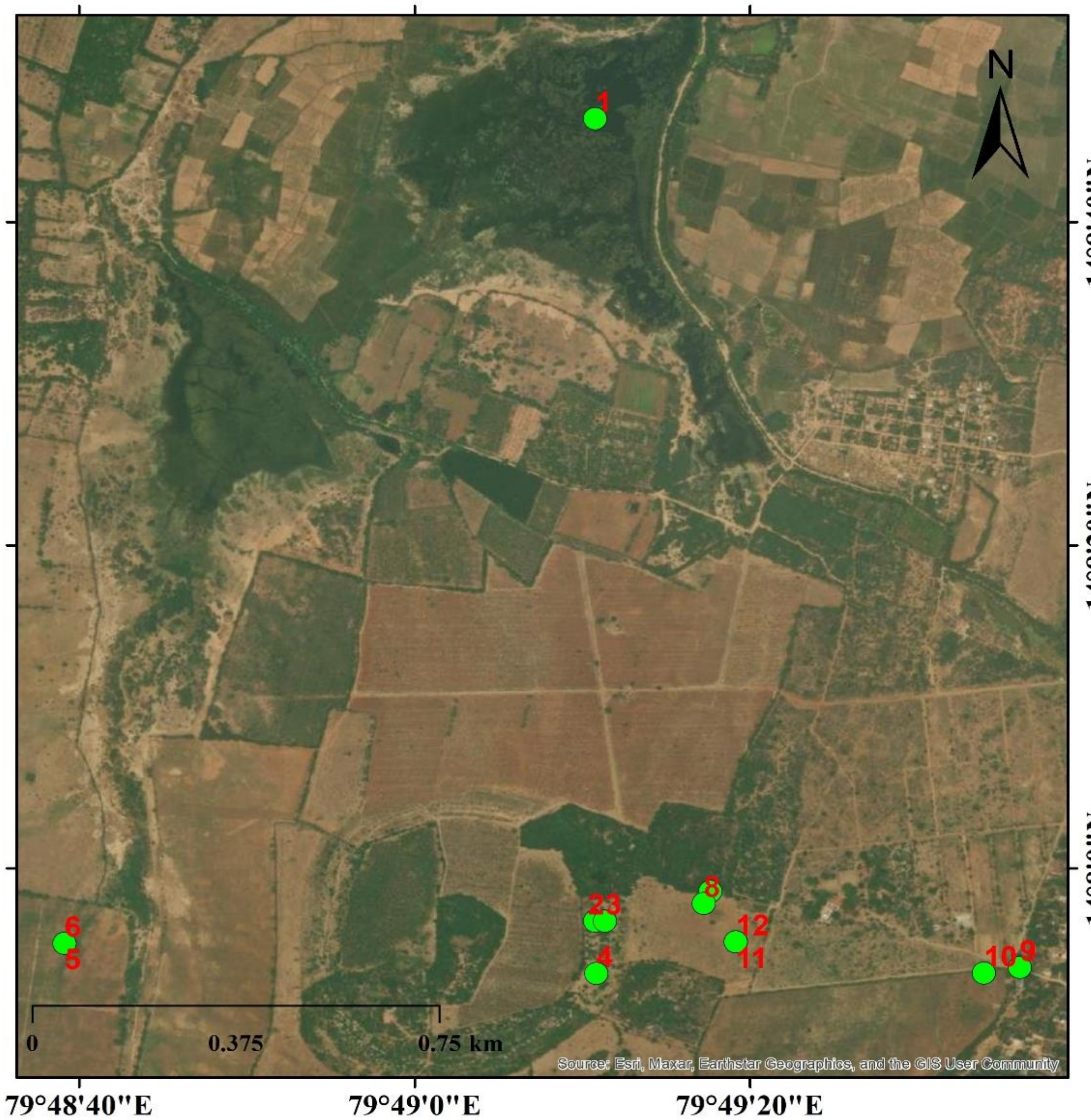


Figure 1: Location map of the study area (West Gudur)

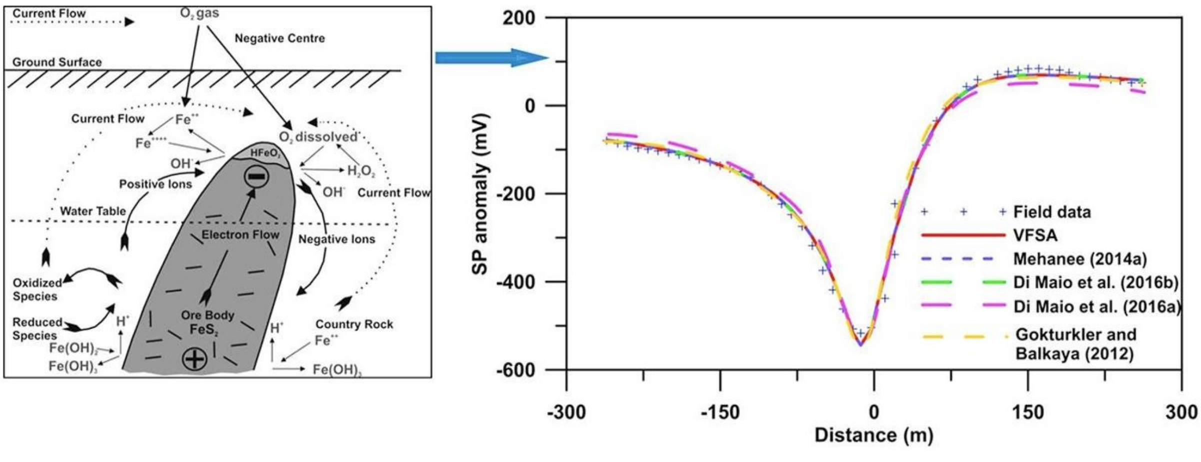
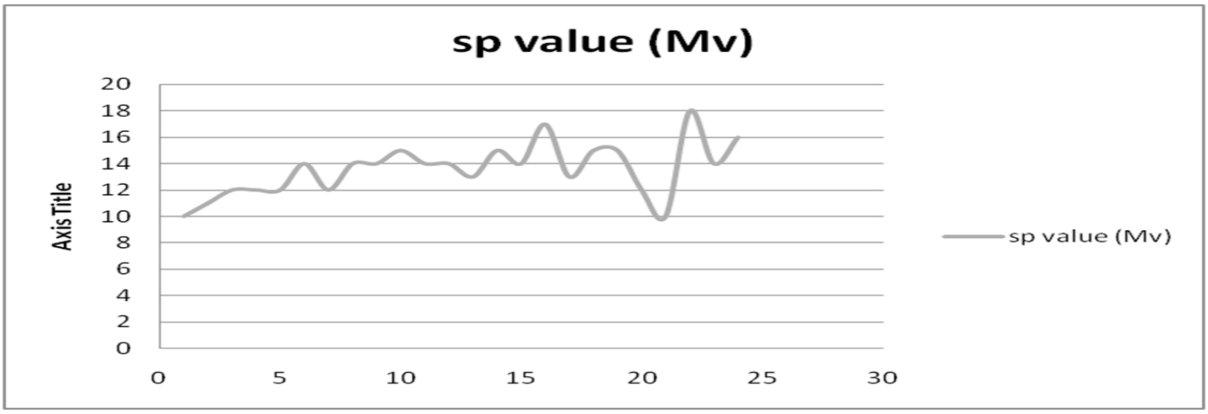


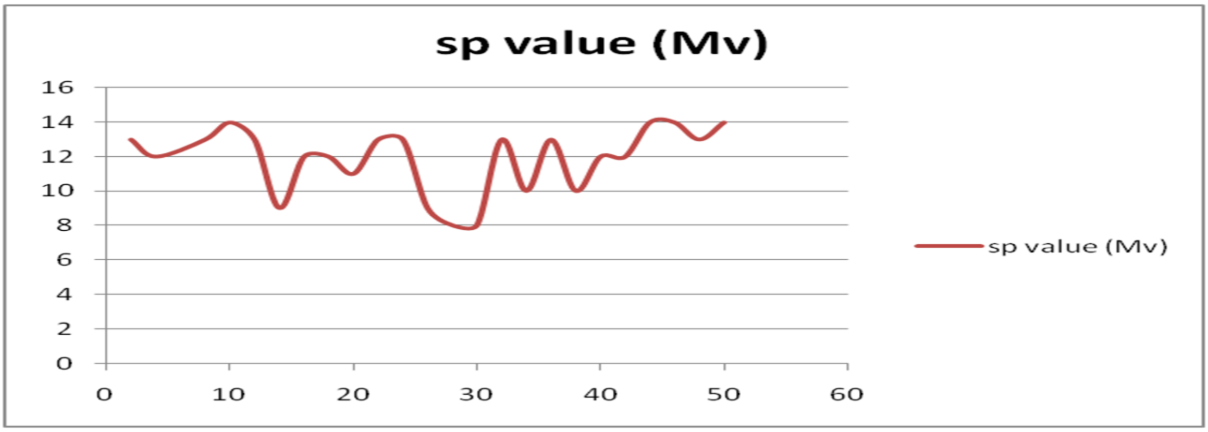
Figure 2: It shows the graphical representation of the anamoly[2]

Self-potential explains the trend of the ore deposits in the study area, whereas the natural electrical sounding explains the vertical depth of the study area as in graphs 1 to 12.

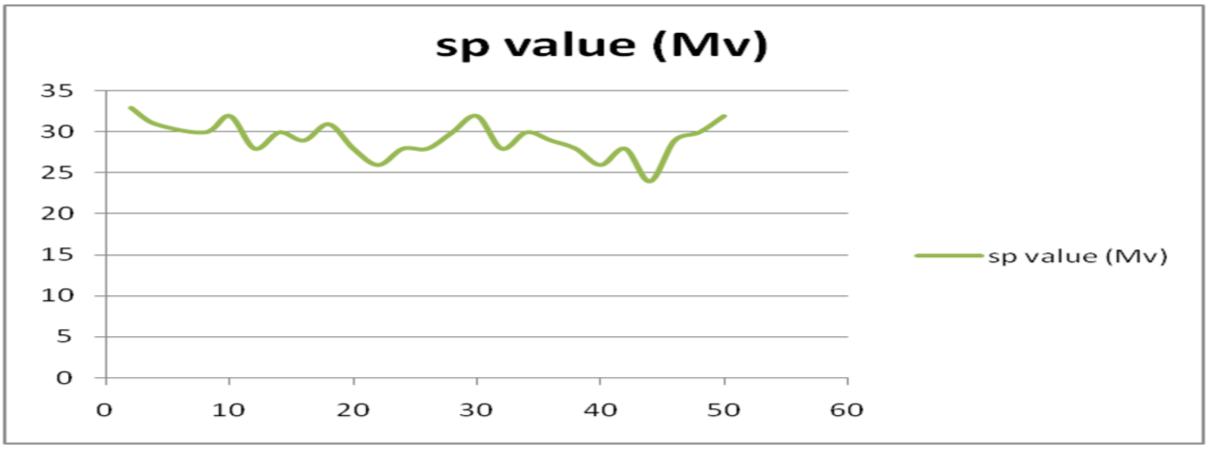
Self-potential method graph plots:



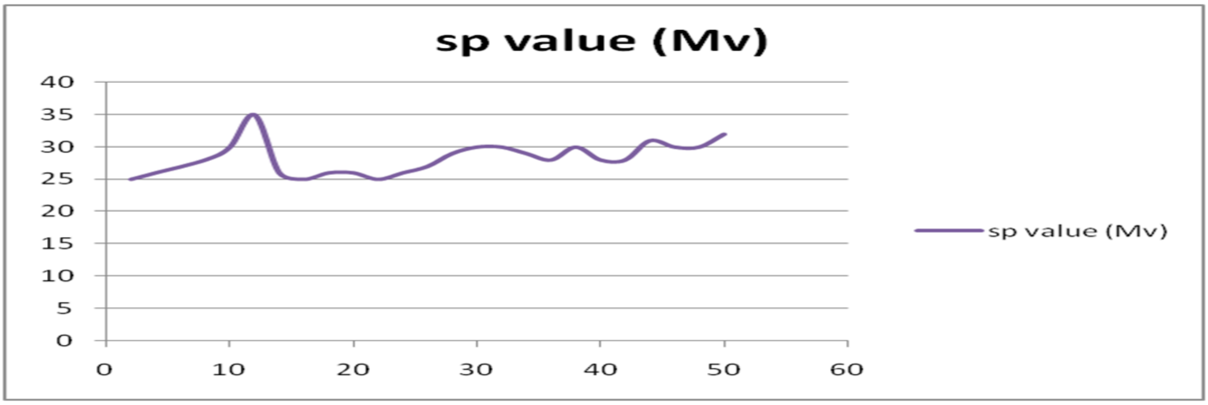
Graph 1: (LAT: 14.146220-LONG-79.819658) (N-S)



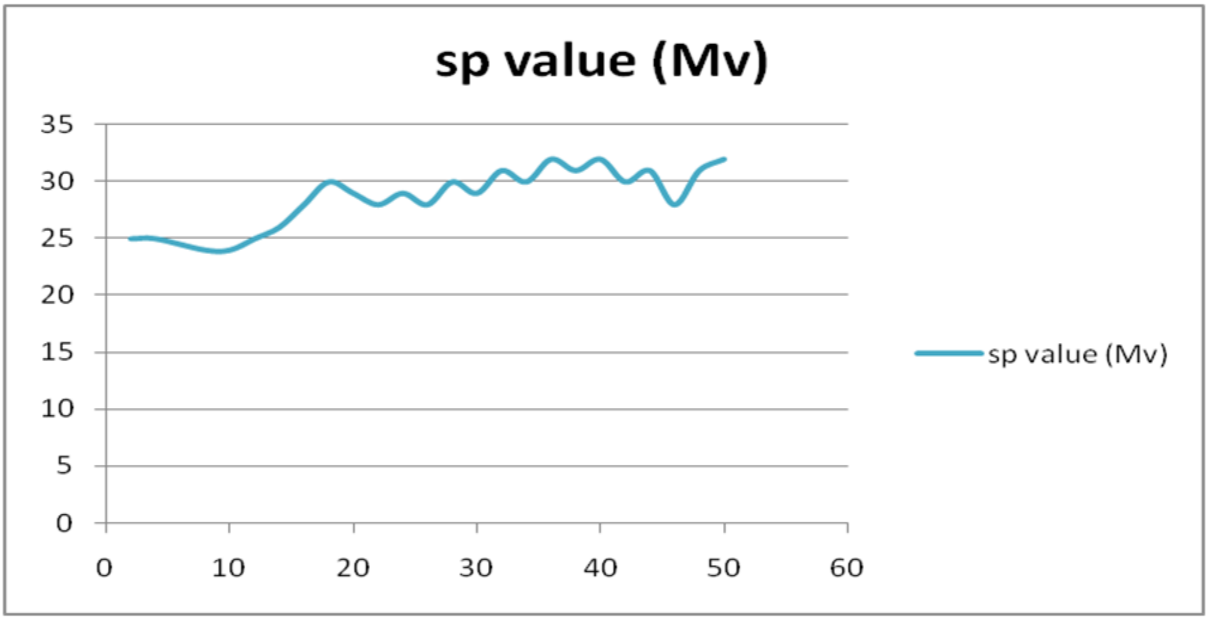
Graph 2: (LAT: 14.132420-LONG-79.819658) (N-S)



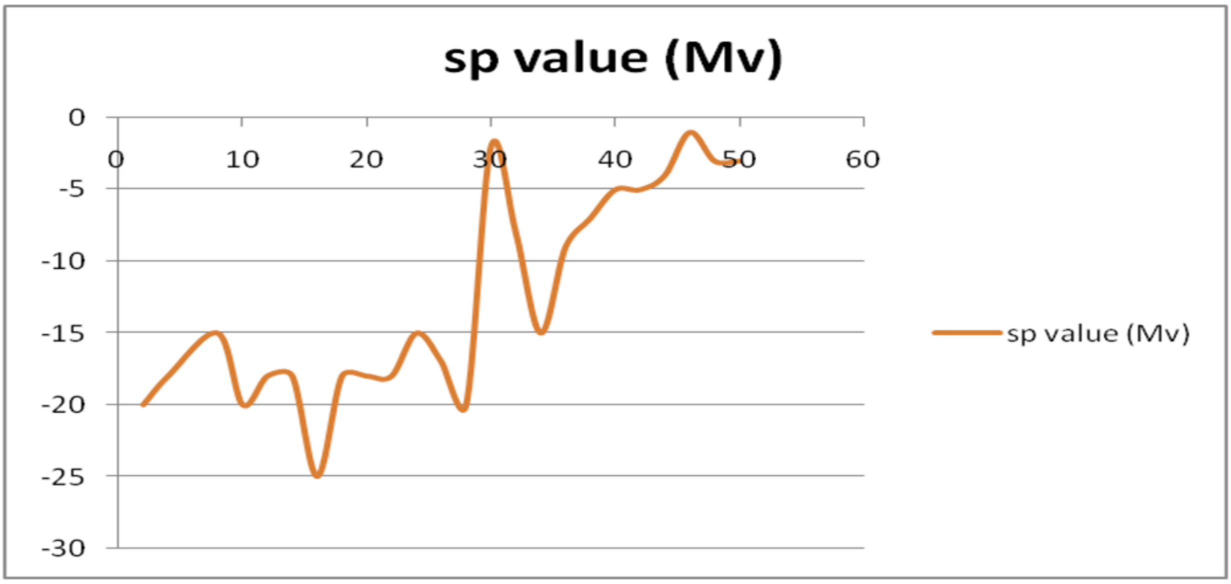
Graph 3: (LAT:14:132420:long:79:819820) (N-S)



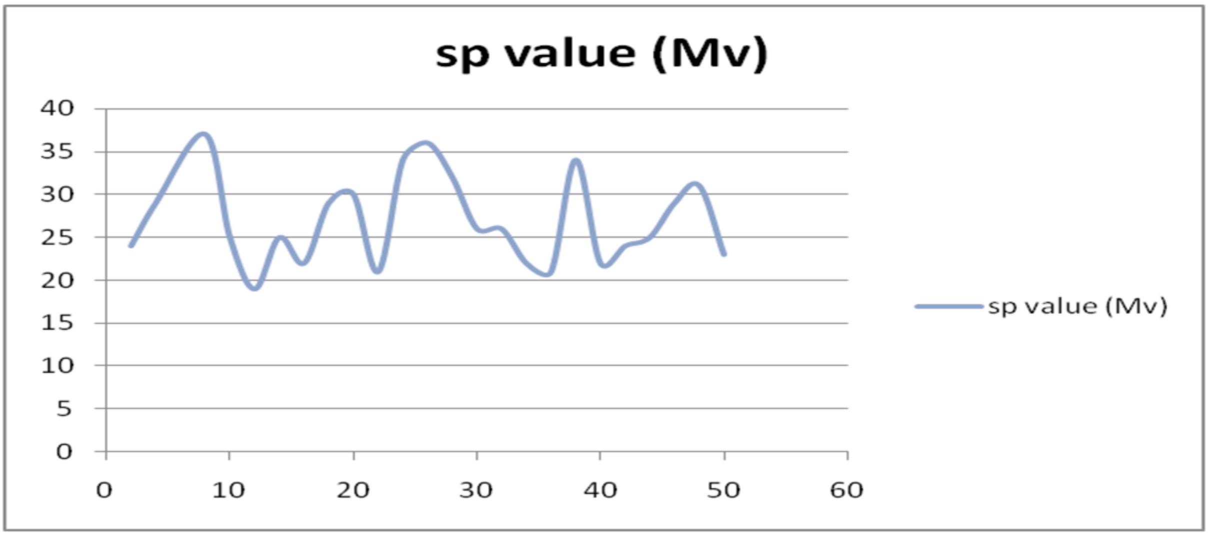
Graph 4: (lat: 14.131520, lon:79:819678) (N-S)



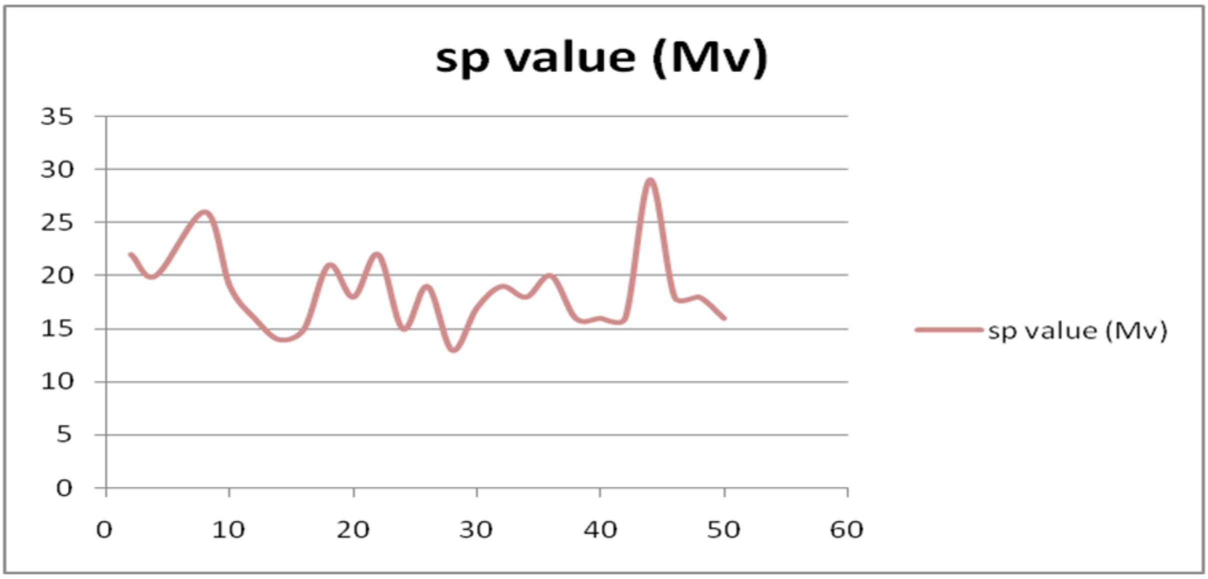
Graph 5: (lat: 14.13203920, lon:79:810863) (E-W)



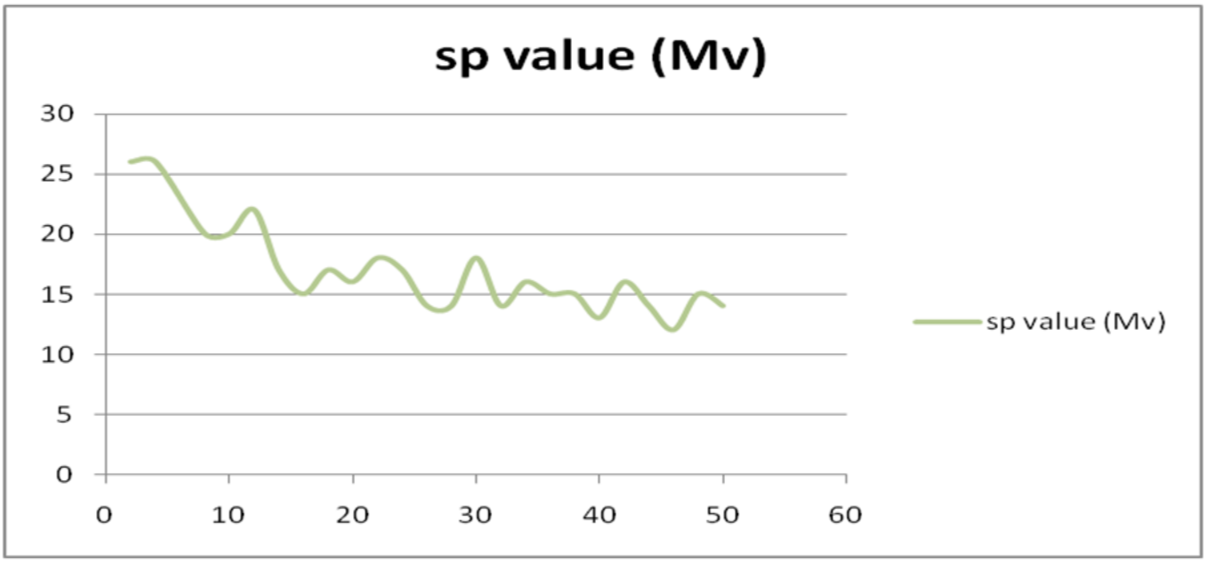
Graph 6: (lat: 14.13203923, lon:79:810866)) (E-W)



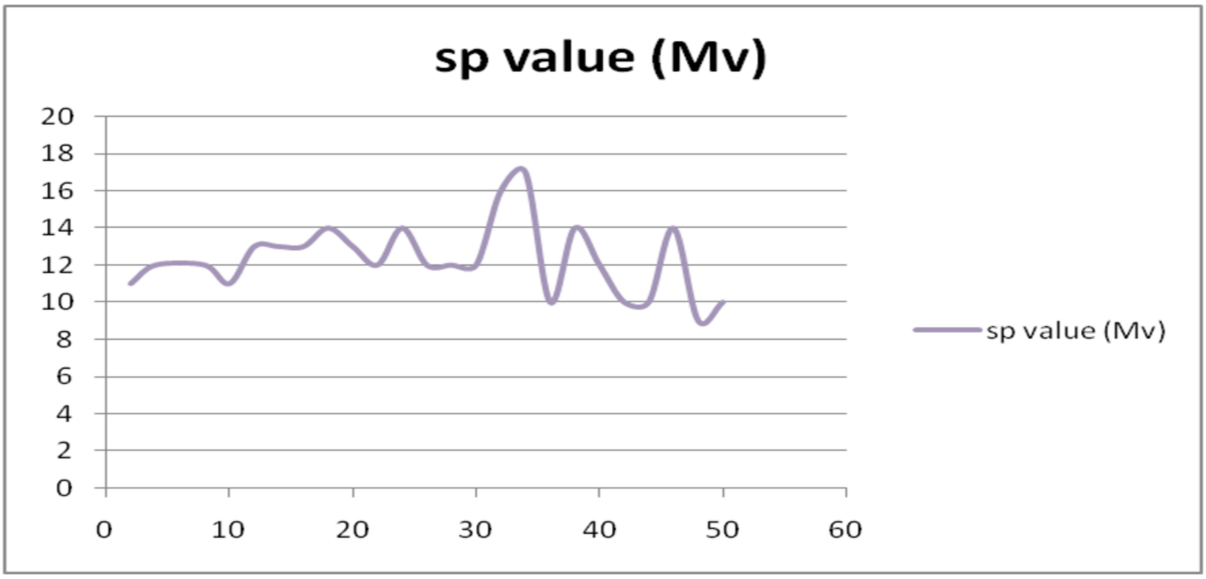
Graph 7: (lat: 14.132927, lon:79:821568)) (E-W)



Graph 8: (lat: 14.132720, lon:79:821458)) (E-W)



Graph 9: (lat: 14.131622, lon:79:826698)) (E-W)



Graph 10: (lat: 14.131522, lon:79:826098)) (E-W)

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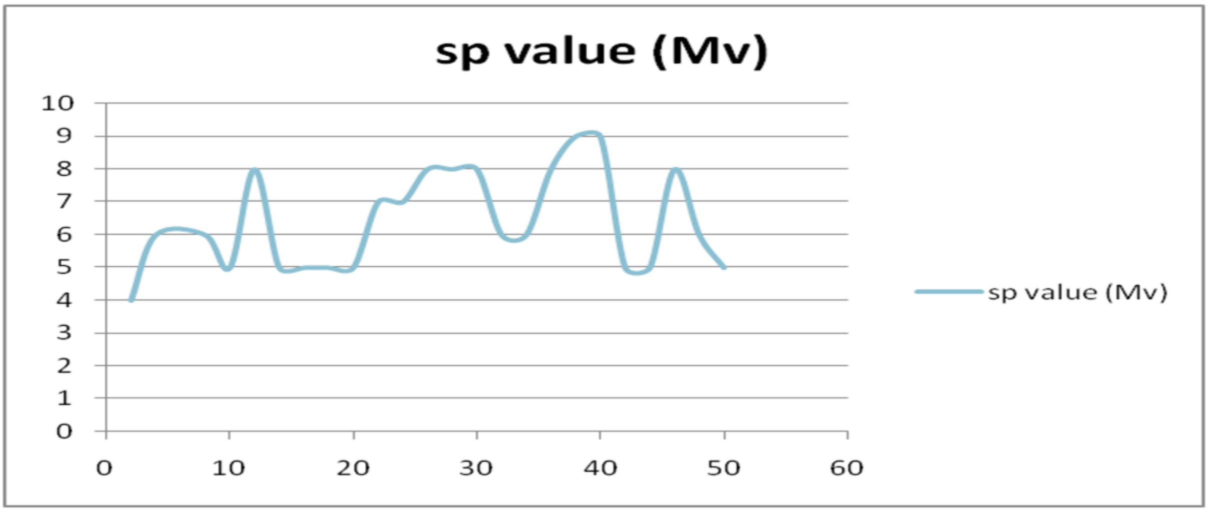
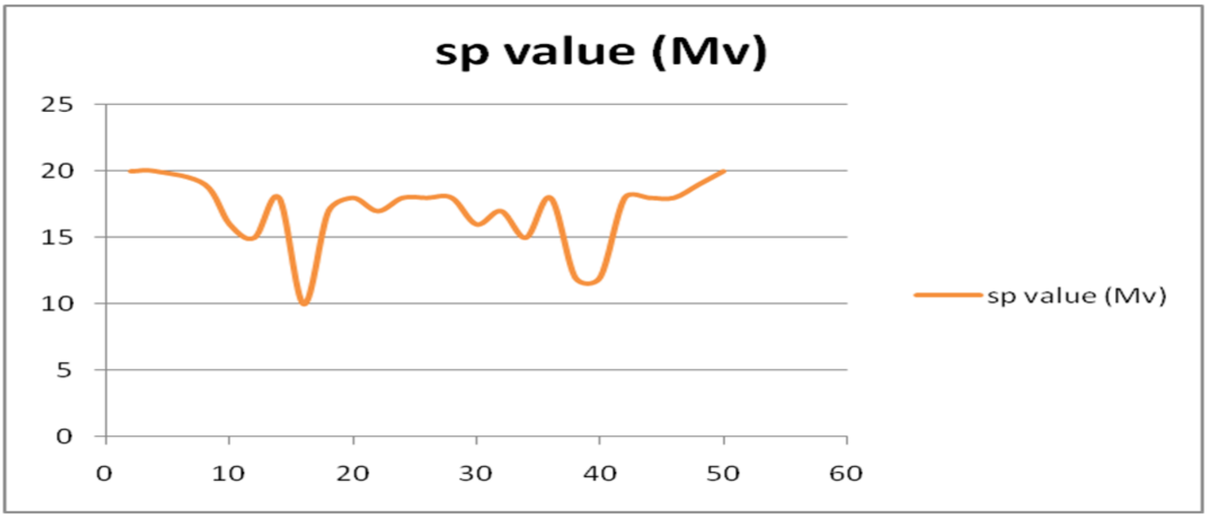
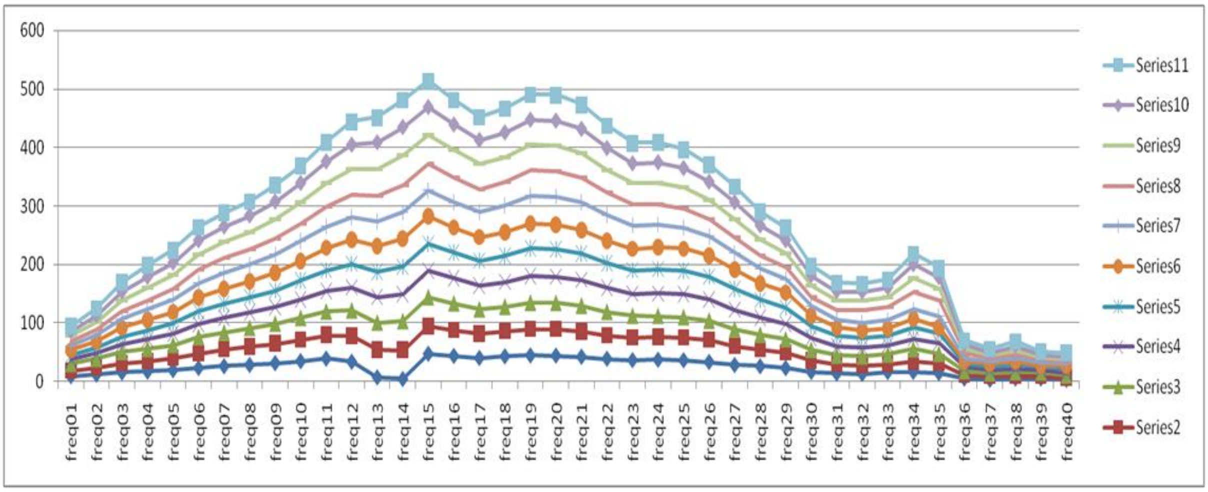


Graph 11: (lat: 14.132062, lon:79:821987)) (E-W)



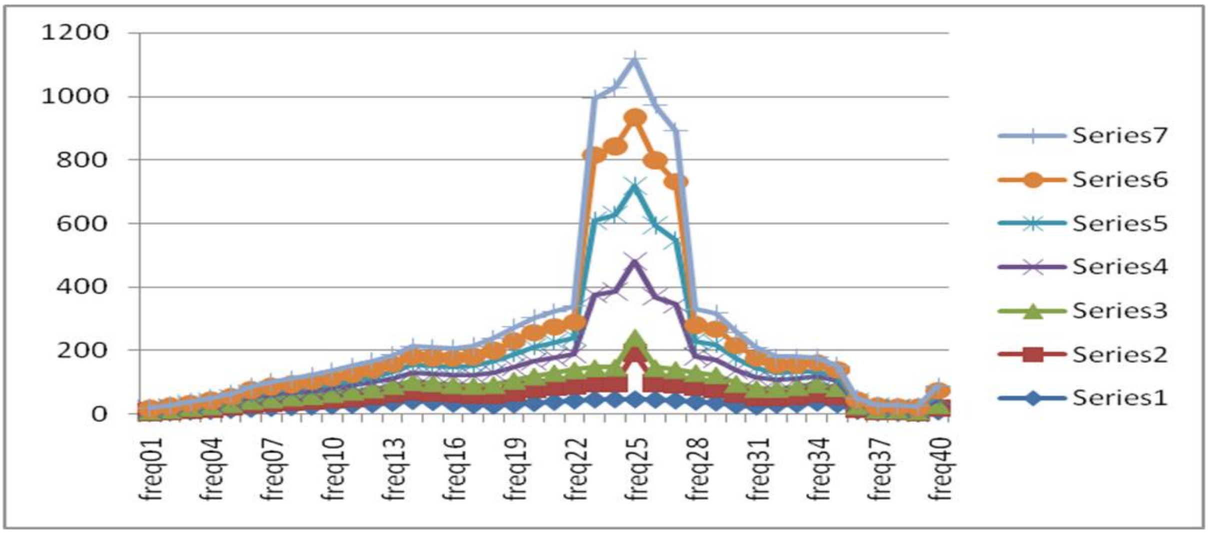
Graph 12: (lat: 14.132062, lon:79:821987) (E-W)

Natural Vertical electrical sounding data graphs: The natural vertical electrical geophysical sound was done by using the PQWT TC -300 model instrument[4,5]. The instrument is working on the electro magneto telluric method. Based on the frequency, an underground formation was shown in variation. Based on frequencies values below 0 mV to >100 mV, the mineral ore body indicates the basement of that area explained in the graphs 13 to 15.



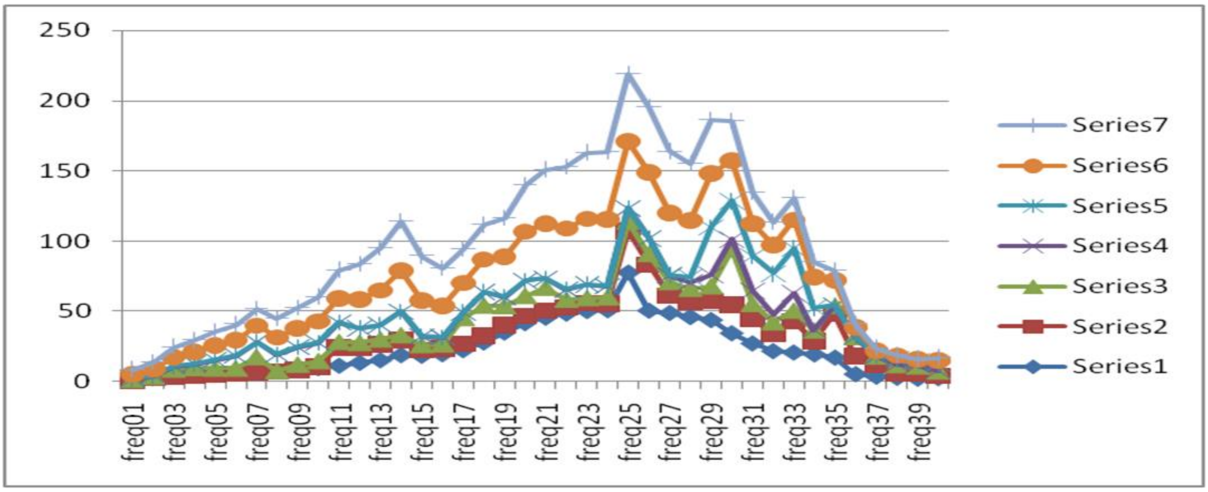
Graph 13: (LAT: 14.146220-LONG-79.819658) (N-S)

The study area vertical data explains that the above latitude and longitude area may contain the quartz group of mineral with a depth of approximately 100 to 150 feets, length 50m and width 15 to 20 feet only.



Graph 14: (LAT: 14.132420-LONG-79.819658) (N-S)

The study area vertical data explains the above latitude and longitude area may contain the schist group rocks only.



Graph 15: (lat: 14.13203923, lon:79:810866)) (E-W)

The study area vertical data explains the above latitude and longitude area and may contain the mica group of minerals with a depth of approximately 100 to 150 ft.

Conclusion

In the study area, from 12 self-potential data points, at points 1, 7 and 6 quartz and mica group minerals may occur. The remaining area fell in the schistose group of rocks. The quartz veins were in the North – South direction whereas the mica may be present in the East –West. The study area's highest millivolt value (30 to 50 mV) indicates the presence of quartz, feldspar and negative values are associated with the mica group of mineral. The Nellore schist belt is majorly dominated by the schistose group of rocks. The schistose group of rocks has a density very less like 5 to 10 mv. This study would be helpful for various social communities like exploration geologist and mining engineers.

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