GEOPHYSICAL INVESTIGATIONS NEAR THE OLD WORKINGS FOR COPPER IN YANAMBAIL* AREA, KHAMMAM DISTRICT, ANDHRA PRADESH

BY B. JANAKIRAMAIAH AND E. V. RAMANA
(Department of Geophysics, Andhra University, Waltair)

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ABSTRACT

The old workings for copper, two miles north of Yanambail were first brought to light by Prof. C. Mahadevan, during his work in the Hyderabad Geological Survey 1941-43.

Self potential, Resistivity and Magnetic methods of geophysical investigations were carried out by the authors near the old workings in an area of about 100 acres covering the entire old workings their strike continuation and in their neighbourhood. Negative centres were obtained near the old workings indicating the possible presence of richly concentrated copper ore body from about 30 feet depth. Another group of Negative centres of high magnitude were also found at a distance of about 500 feet towards East of old workings along a run of quartz vein. They are possibly due to the presence of another parallel mineralised vein.

INTRODUCTION

YANAMBAIL is a small village on the left bank of Kinnerasani about 8 miles north of Paloncha in Khammam district (East longitude = 80° 40' North latitude = 17° 41').

The old workings for copper, two miles North of Yanambail were brought to light first by Prof. C. Mahadevan during his regular survey work as an Officer of Hyderabad Geological Survey, in the year 1943, who mapped the area on a 1" = 2 miles scale.

The formations consist here of alternate bands of phyllites, dolomitic marbles and quartzites, with concordant intrusions of quartz veins, the junction between the marbles quartzites, and phyllites is well defined. The phyllites are mostly salicitic and occasionally slightly carbonaceous. They strike near the old workings NNE-SSW and dip 70°-80° to the West, sometimes being almost vertical.

* Written as Yellambailu in topsheet No. 65 C/N.E.
The old workings for copper are situated about 1 mile to the west of the hill range of Karagutta and are on level ground. They run in the strike direction over a length of 1000' with a maximum width of 50' and a maximum depth of 25' from the general ground level. Chalcopyrite, malachite, and less frequently cuprite, and other copper ore minerals occur in profusion in the debris filling the old workings. Detailed prospecting by trenching was conducted by a party of teachers and M.Sc. students of the Departments of Geology, of Andhra University and Osmania University, in the months of May and June 1957. Simultaneously the teachers and students of Geophysics Department, Andhra University, carried out detailed geophysical investigations in the old workings and vicinity. The results of geophysical investigations are recorded here.

METHODS OF WORK

The basic principle of the geophysical methods is the measurement at surface, of the differences in physical properties of the subsurface geological bodies. Since the ore body near the old workings is chalcopyrite which is susceptible for oxidation, resulting in natural earth currents, intensive self-potential survey of the area was undertaken. To supplement the self-potential work, resistivity and magnetic work was also done.

When ore deposits get oxidised, natural earth currents are produced as a result of which the ground immediately above the ore body becomes an area of negative potential with respect to all distant points at the surface. The point of maximum negative potential in the area is known as the "negative centre" and it is the location of these "negative centres" which is the main objective when the self-potential method is used for prospecting purposes.

For the purpose of the geophysical work a grid was laid down in the area with traverses ESE–WNW (i.e., N 113° E) perpendicular to the general strike direction of the formations there (vide Fig. 1). The distance between any two consecutive traverses was 100' and on each traverse stations were fixed at 50' interval marked by pegs. An arbitrary point about 500' west of the old workings was taken as the base station and was denoted as 0/0 station and all the potentials were measured with respect to this point. The traverse passing through this point was called '0' traverse and the traverses towards north of this line were denoted as 1 N, 2 N, 3 N, etc., which were at a perpendicular distance of 100', 200', 300', etc., respectively from the '0' traverse. Similarly traverses towards south were denoted as 1 S, 2 S, 3 S, etc. The stations on each traverse towards the east of the reference point were denoted as 1 E, 2 E, 3 E, etc. A total number of 19
traverses were laid down and on every traverse reading at about 40 stations were taken.
Geophysical Investigations for Copper in Yanambail Area

Along these traverse lines Abney’s level measurements were taken at intervals of 50' to get the profiles, and the geological information was also recorded. Geological sections were prepared from the data so that the geophysical data curves can be appreciated when superposed on the geological sections (vide Figs. 2 a to 2 f).

Tinsley potentiometer and non-polarising electrodes were used to make self-potential measurements. Before starting the work all the non-polarising
electrodes were placed at the same place and the P.D. between any two was measured. The pair having the minimum P.D. was taken for that day's work. One electrode was placed at the base station, the station with reference to which the potentials of all the other stations were measured, and the other electrode was placed at a station whose potential was to be measured and the potential difference was measured by means of the Tinsley potentiometer. Thus the potentials of all the stations with respect to the base station were measured. After the day's work, the electrodes were left
standing in a dish of concentrated copper sulphate solution with their terminals interconnected with short lengths of wire to ensure that the electrodes will be in equilibrium when the survey is continued on the following morning.

DISCUSSION OF THE RESULTS OF SELF-POTENTIAL SURVEY

Self-potential readings were taken at about 660 stations. Self-potential profiles were drawn for all traverses (vide Figs. 2a to 2f), and an equipotential line map was also prepared (vide Fig. 3),
A grid map (vide Fig. 1) on which points of maximum negative potential were marked on each traverse, was prepared. The outline of the old workings was also traced on this map. An examination of this figure shows that there are two distinct self-potential low areas. One of the areas is coinciding with the old workings, the maximum negative potential being 100 millivolts at 2 N/12 E station. The other is along the flank of a high ground running approximately parallel to the old workings. The negative potential obtained here is comparatively high, the maximum negative potential being 200 millivolts 8 S/18 E station, indicating the presence of a mineralised zone or the presence of a subsurface carbonaceous material. Unless some trial pits are excavated it is very difficult to say positively. If the higher negative potentials in the second area are due to a concealed mineralised zone then this zone also is likely to contain copper ore body.
Resistivity readings were taken with geophysical Megger. Variable electrode separation method was carried out near the stations 2 N/12 E and 8 S/18 E where the negative potentials are maximum. Both the curves (vide Figs. 4 a and 4 b) show that the resistivity decreases from the surface up to a depth of about 20 to 30 ft. and then gradually increases. The depth to the second layer at 2 N/12 E station is about 23 ft. and at 8 S/18 E is about 30 ft. Representative samples showing primary mineralisation by copper as well as
Geophysical Investigations for Copper in Yanambail Area

Fig. 3
secondary alterations and enrichment were collected with a view to determine their resistivity in the laboratory and the work is under progress.

MAGNETOMETRIC SURVEY OF THE AREA

A Schmidt type vertical force variometer was employed in the area to investigate any variation in the vertical component of the earth's magnetic field. Magnetically the area was found to be flat indicating no magnetic anomalies.

CONCLUSION

Geophysically the anomalies over the old workings indicate that the lode might be continuing still underneath. The higher anomalies that were obtained over the second zone may be indicative of another fruitful area. However the geological evidence over the second zone is scant since much of the area is covered by spreads of broken vein quartz. In order to confirm the geophysical data it would be necessary to drill boreholes at suitable places, where indications are favourable to pick up the lode if any at depth. This will incidentally indicate the advisability of the extension of boring in the second area of "negative centres". If a lode of economic importance is met with, it is possible that it continues still southwards.
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REFERENCES

Broughton Edge, A. B. and Laby, T. H..
Heiland, C. A. .. Geophysical Exploration.

Principles and Practice of Geophysical Prospecting.