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Identification of Stratigraphic Sequence in Alate Village with the Help of Resistivity Survey

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***Abstract:** Electrical resistivity survey is best tool to understand the subsurface geology. Direct current resistivity survey of Alate village, Kolhapur district of Maharashtra, was conducted using the Wenner electrode configuration at 5 stations. The present studies are an attempt to delineate he stratigraphy of the study area. The resistivity data in the study region shows the contrast in ground strata. The VES data should be used for groundwater exploration in different geological terrains where there is a severe scarcity of groundwater. This will further enhance the accuracy of location of groundwater potential zones in the study area.*
***Keywords:** Vertical Electrical Sounding, stratification, Alate Village.*

I. INTRODUCTION

In areas where limited surface water is available, groundwater constitutes significant part of water resources. In developing country like India, the minimum daily water requirement of a person is 200 liters for domestic use, while an equal or large amount will be needed for other purposes. Groundwater is naturally replenished by surface water form precipitation. Various geophysical techniques are available for subsurface investigation, but the most commonly used is the Electrical Resistivity Method.

Hydrogeological and geophysical investigations in the Deccan trap region (Bose and Ramakrishna, [1], Singhal, [6], Pawar et al. [2], Rai et al., [3], Ratnakumari et al., [5]) were carried out to demarcate aquifers and study the occurrence and movement of groundwater in the intertrappeans /vesicular and fractured zones within the trap sequence and sedimentary formations below the traps, which are considered to be a potential source of groundwater. Rai et al. [4] further suggested the following probable resistivity ranges for different litho units in the Deccan basalts: 5-10 Ω-m - black cotton soil, bole beds, clay; 10-20 Ω-m-sand with clay; 20-40 Ω-m -weathered/fractured vesicular basalt saturated with water; 40-70 Ω-m - moderately weathered/fractured basalt/vesicular basalt saturated with water; > 70 Ω-m - hard and massive basalts. These ranges may slightly differ on either side from place to place depending on the percentage of clay, joints/fractures.The present study attempts to decipher the existing stratification in the Alate village, Kolhapur district using Vertical Electrical Sounding (VES) technique. Wenner arrangement was carried out at 5 selective stations in the study area using Aquameter CRM-20 resistivity meter.

II. STUDY AREA

The Alate village of Kolhapur District in Maharashtra State is bounded between latitude**:** N 16.7409 to N 16.7688 & N 16.7748 to N 16.7280and longitude E 74.3112 to E 74.3452 & E 74.3363 to E 74.3245 (**Fig. 1**). The study area is covered by Deccan trap of Upper Cretaceous to Lower Eocene in age. Groundwater is the main source used for drinking, irrigation and industrial purposes.

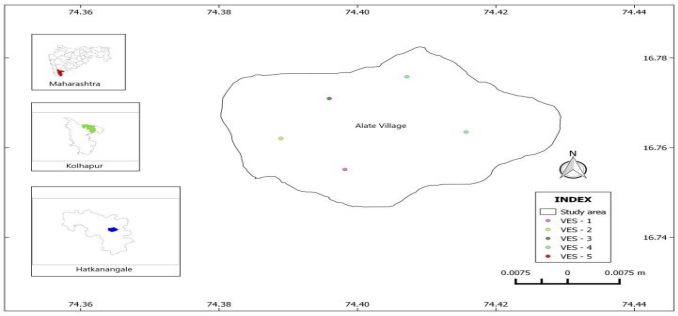


Figure 1: Map of Alate village with VES locations.

III.METHODOLOGY

For identifying stratigraphy, 5 Vertical Resistivity Sounding (VES) were taken from different parts of the study area. The data obtained from VES was interpreted and finding out resistivity (Table No. 1).

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IV.RESULT AND DISCUSSION

The development of surface water, groundwater and planning for any civil engineering projects ground strata is important. The geophysical method like vertical electrical sounding (VES) is helpful to demarket the stratigraphy of the study area. 5. stations were selected for VES to demarket the ground strata.

1.The vertical electrical sounding-I (VES-I) shows that resistivity value of depth 0-85 m is ranging from 77.370-138.964 ohm-m which describes compact basalt.It depict that the lithology category is poor due to this the area is having low artificial recharge zone and also ground water level availability point of view. The vertical electrical sounding-I (VES-I) shows that resistivity value of depth 90-100 m is ranging from 59.032-71.780 ohm-m which describes moderately weathered fractured basalt or vesicular basalt.It depict that the lithology category is moderate due to this the area is having moderate artificial recharge zone and also ground water level availability point of view.

2.The vertical electrical sounding-II (VES-II) shows that resistivity value of depth 0-2 m is ranging from 54.448-67.824 ohm-m which describes moderately weathered fractured basalt or vesicular basalt.It depict that the lithology category is moderate due to this the area is having moderate artificial recharge zone and also ground water level availability point of view. The vertical electrical sounding-II (VES-II) shows that resistivity value of depth 3-100m is ranging from 81.200-120.576 ohm-m which describes compact basalt .It depict that the lithology category is poor due to this the area is having poor artificial recharge zone and also ground water level availability point of view.

3.The vertical electrical sounding-III (VES-III shows that resistivity value of depth 0-5 m is ranging from 46.912-67.196 ohm-m which describes moderately weathered fractured basalt or vesicular basalt.It depict that the lithology category is moderate due to this the area is having moderate artificial recharge zone and also ground water level availability point of view. The vertical electrical sounding-III(VES-III) shows that resistivity value of depth 6-35 m is ranging from 75.360-211.228 ohm-m which describes compact basalt.It depict that the lithology category is poor due to this the area is having poor artificial recharge zone and also ground water level availability point of view.

The vertical electrical sounding-III (VES-III) shows that resistivity value of depth 40-100 m is ranging from 9.420-12.874ohm-m which describes Alluvium and Red bole.It depict that the lithology category is good due to this the area is having good artificial recharge zone and also ground water level availability point of view.

4.The vertical electrical sounding-IV (VES-IV) shows that resistivity value of depth 0-1m is ranging from 66.066ohm-m which describes moderately weathered fractured basalt or vesicular basalt.

It depict that the lithology category is moderate due to this the area is having moderate artificial recharge zone and also ground water level availability point of view.

The vertical electrical sounding-IV (VES-IV shows that resistivity value of depth 2-90m is ranging from 79.756-117.449 ohm-m which describes compact basalt .It depict that the lithology category is poor due to this the area is having poor artificial recharge zone and also ground water level availability point of view.

The vertical electrical sounding-IV (VES-IV) shows that resistivity value of depth 95-100m is ranging from 55.892-57.274 ohm-m which describes moderately weathered fractured basalt or vesicular basalt.It depict that the lithology category is moderate due to this the area is having moderate artificial recharge zone and also ground water level availability point of view.

5.The vertical electrical sounding-V (VES-V) shows that resistivity value of depth 0-2m is ranging from 65.124-69.457ohm-m which describes moderately weathered fractured basalt or vesicular basalt.

It depict that the lithology category is moderate due to this the area is having moderate artificial recharge zone and also ground water level availability point of view. The vertical electrical sounding-V (VES-V shows that resistivity value of depth 3-80m is ranging from 72.911-116.400 ohm-m which describes compact basalt.It depict that the lithology category is poor due to this the area is having poor artificial recharge zone and also ground water level availability point of view.

The vertical electrical sounding-V (VES-V) shows that resistivity value of depth 85-100m is ranging from 48.356-60.853ohm-m which describes moderately weathered fractured basalt or vesicular basalt.It depict that the lithology category is moderate due to this the area is having moderate artificial recharge zone and also
ground water level availability point of view.

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Table No. 1: Observed resistivity values at VES Location

Sr. No.	Depth of Penetration	Resistivity in Ωm				
		VES – I	VES – II	VES – III	VES - IV	VES - V
1	1	18.670	8.670	7.470	10.520	10.370
2	2	9.973	5.400	4.750	6.350	5.530
3	3	7.354	4.310	3.090	4.660	3.870
4	4	5.532	3.590	2.320	3.650	3.110
5	5	3.122	3.120	2.140	2.890	2.560
6	6	2.781	2.680	2.000	2.360	2.200
7	7	2.460	2.290	1.898	1.990	1.911
8	8	2.059	2.070	1.843	1.843	1.701
9	9	1.986	1.970	1.702	1.637	1.495
10	10	1.754	1.754	1.630	1.487	1.379
11	12	1.376	1.467	1.448	1.384	1.211
12	14	1.014	1.226	1.211	1.271	1.079
13	16	0.984	1.089	1.075	1.139	1.024
14	18	0.746	0.944	0.967	1.039	0.935
15	20	0.872	0.872	0.916	0.937	0.898
16	25	0.523	0.623	0.806	0.727	0.721
17	30	0.470	0.506	0.690	0.587	0.603
18	35	0.329	0.429	0.961	0.502	0.526
19	40	0.312	0.423	0.053	0.430	0.451
20	45	0.278	0.391	0.044	0.408	0.430
21	50	0.294	0.384	0.041	0.365	0.326
22	55	0.246	0.348	0.369	0.340	0.337
23	60	0.214	0.315	0.027	0.321	0.235
24	65	0.198	0.265	0.035	0.275	0.233
25	70	0.184	0.238	0.029	0.250	0.196
26	75	0.176	0.221	0.027	0.211	0.175
27	80	0.154	0.214	0.025	0.189	0.166
28	85	0.149	0.199	0.022	0.177	0.114
29	90	0.127	0.184	0.020	0.163	0.093
30	95	0.118	0.176	0.018	0.096	0.087
31	100	0.094	0.141	0.015	0.089	0.077

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V. CONCLUSION

A total of 5 vertical electrical resistivity soundings were carried out over the Alate village (Fig. 1**)** in Kolhapur district to identify stratigraphic sequence. The resistivity obtained suggests ground strata of the study area is quite heterogeneous Table No. 2 shows the depth wise stratification of Alate village.

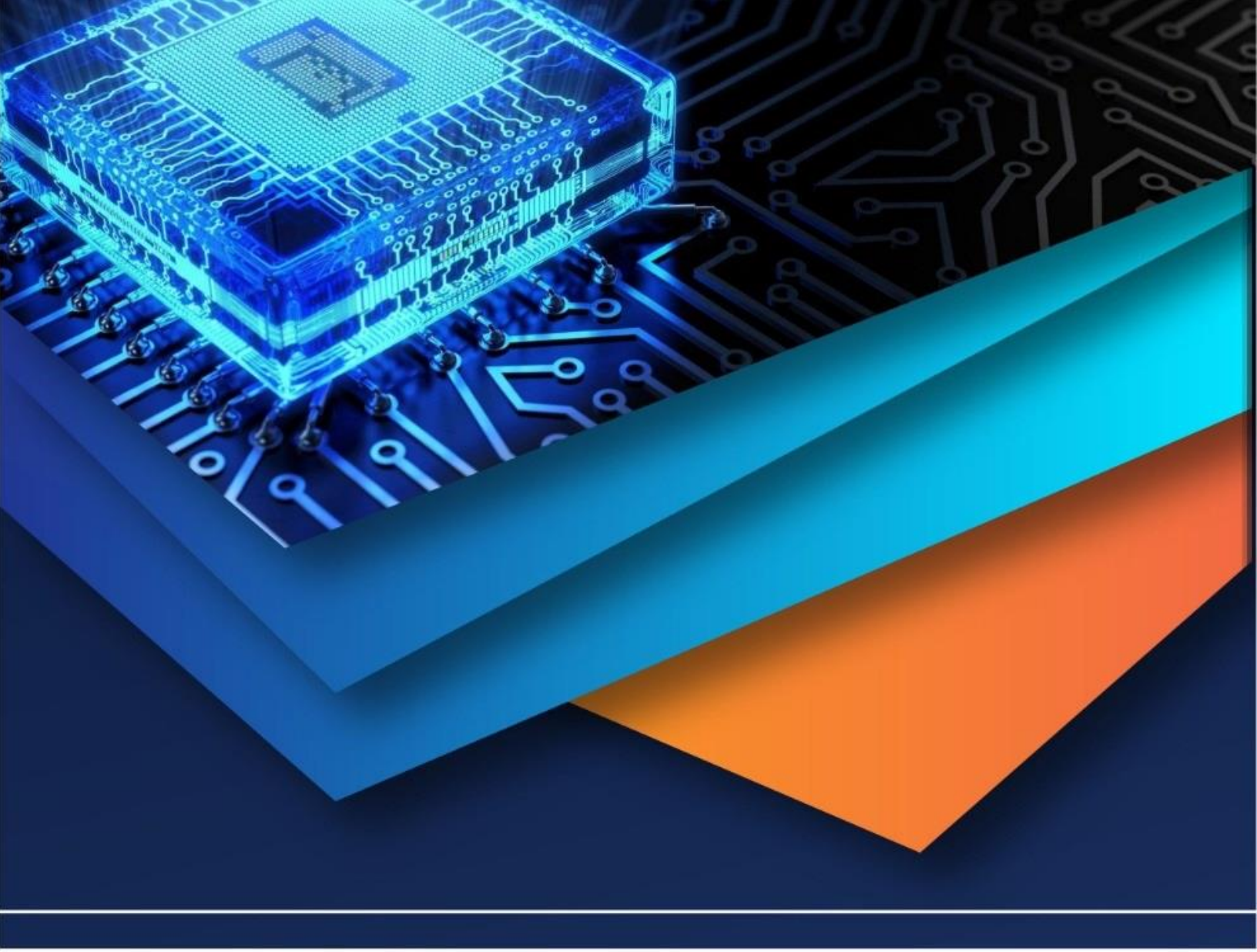
Table No. 2: Stratigraphic sequence of the Study area.

VES No.	Location (East longitude, North latitude)	Resistivity (ρ) (Ohm-m)	Thickness (h) (m)	Depth (m) from ground surface	Lithological classification
I	16.75519 N 74.39811 E	77.370 – 138.964 59.032 – 71.780	0 – 85 90 – 100	CB MWFB/VB	POOR MODERATE
II	16.67204 N 74.38886 E	54.448 – 67.824 81.200 – 120.576	0 – 2 3 – 100	MWFB/VB CB	MODERATE POOR
III	16.77101 N 74.39592 E	46.912 – 67.196 75.360 – 211.228 9.420 – 12.874	0 – 5 6 – 35 40 – 100	MWFB/VB CB AL/RB	MODERATE POOR GOOD
IV	16.77588 N 74.40707 E	66.066 79.756 – 117.449 55.892 – 57.274	0 – 1 2 – 90 95 – 100	MWFB/VB CB MWFB/VB	MODERATE POOR MODERATE
V	16.76352 N 74.41568E	65.124 – 69.457 72.911 – 116.400 48.356 – 60.853	0 – 2 3 – 80 85 – 100	MWFB/VB CB MWFB/VB	MODERATE POOR MODERATE

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