



"The contributed chapters in the book written by the faculties of science stream in the light of the recent thinking and developments in the field of science and education. Science & Technology is now dominates almost every field of our activities in summary, The faculties (Science stream) of GEMS Arts & Science college have made an excellent attempt to bring about this book *Homo-Scientia* covering almost all the important areas from biological sciences to artificial intelligence. Every article has its own merits in both academic and research fronts. I record my grateful appreciation and thanks to the contributors of this book for their untiring efforts."

Dr. Balagopalan Unni



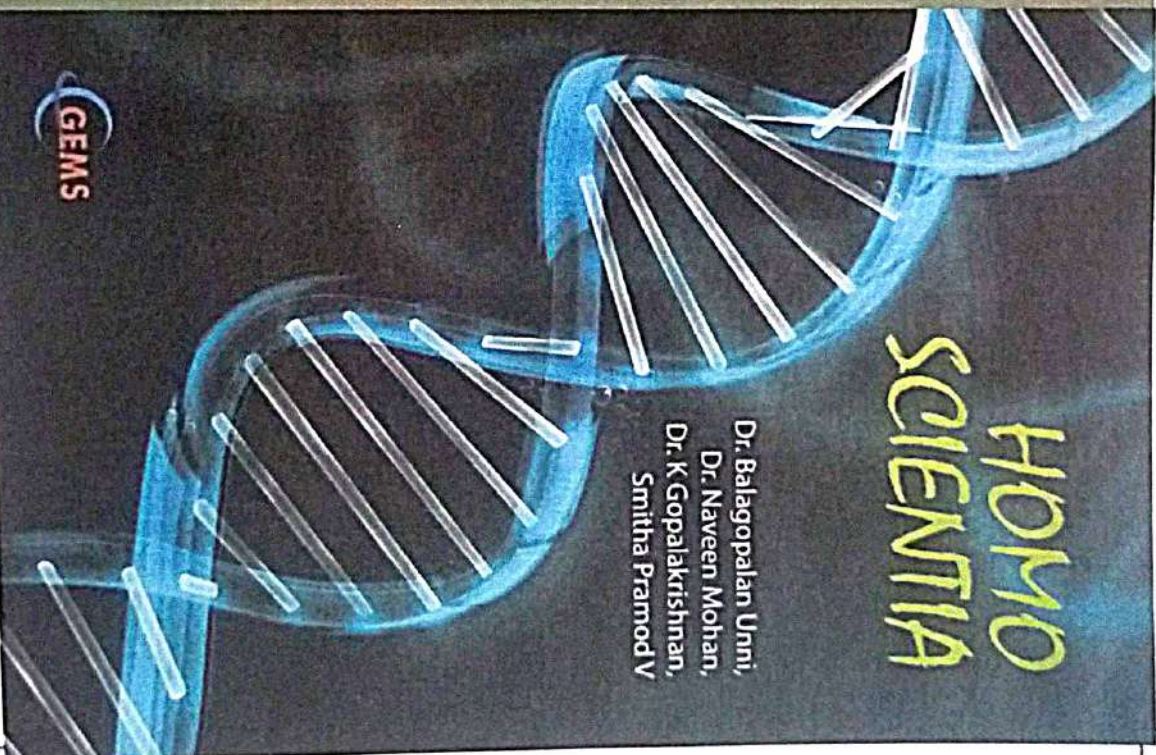
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HOMO SCIENTIA

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HOMO SCIENTIA



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Brief Biography

Dr. B.G.Unni, (Balagopalan Unni) Ph.D
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Former Chief Scientist and Area Coordinator (Biotechnology & Biological Sciences) DADD and Fulbright Fellow retired from CSIR service in 2015 after 38 years of research career at CSIR North East Institute of Science & Technology Jorhat Assam. Appointed at Assam down town University as Director-Research in March 2015 and continued up to June 2019 and then re-designated as Adviser Research in August 2019). Back in Kerala, Dr.Unni is appointed as Director Academic & Research at GEMS College of Arts & Science affiliated to University of Calicut from August 2019. Both the positions are on honorary basis to strengthen the institutions in research areas. He did his BSc Biology (1972-74, Ewing Christian College, Alld University), MSc in Biochemistry(1974-76)(Second Rank) and Ph.D in Biochemistry from Allahabad University(1976-80) and PDF in Molecular Biology from Texas A&M University, USA(1988-91). Dr. Unni is specialized in Biochemistry, Molecular Biology, and Biotechnology and well established in his area of research and completed more than 40 years of research in both basic and applied fields of research. Dr.Unni got more than 130 research papers, 190 abstracts, 35 papers in proceedings, 7 patents, 1 technology. 18 chapters in books, edited 3 books and 29 students




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received PhD degrees under his guidance and supervision. Dr. Unni had completed more than 20 projects sponsored by Commonwealth Science Council, London, Ministry of Non conventional Energy Sources, Department of Non conventional Energy Sources Govt of India, North Eastern Council Govt of India, Department of Science & Technology, Department of Biotechnology, Central Silk Board, GB Pant Institute of Himalayan Environment and Development, CSIR and DRDO, Ministry of Defense, Govt of India during his scientific tenure at CSIR NEIST. Dr Unni received- Fulbright Travel Award/ Fellowship (USA) Dr. B.M. Das Memorial Science award, Hebrew University Award , H.R. Cama Memorial Travel Award, COSTED Travel Award, DAAD- fellowship-Germany, Well Mark International Scholarship (USA) & Technology award in life sciences by CSIR, Govt of India . Best Fulbright Alumni Chapter Leader-South Asia Selected by the United States Education Foundation In India (USIEF), New Delhi .Nominated to represent India at the International Fulbright Scholars meet at Marrakech, Morocco- Nominated by United States Education Foundation In India, New Delhi . Dr. Unni is in the editorial board of more than eight indexed journal in the country .Dr.Unni was nominated to various state and central committees such as High power committee for development of sericulture activities Muga, Eri, Tassar and Mulberry in Assam nominated by Governor of Assam, .Expert in the area of non mulberry sericulture, Ministry of Textiles, Advisory Board, Post graduate Biotechnology programme, Academic Council, Assam Agricultural University, Research Council, Central Silk Board, Ministry of Textiles , DBT's Nominee for Biosafety Committee , Vice President SBC (India) Indian Institute of Science Bangalore, Vice President Indian Academy of Neuro-sciences, Member Fulbright Academy of Science & Technology, USA, Board of studies- Botany Nagaland University and Biotechnology Saugar University Madhya Pradesh., Fellow, Indian Academy of Neurosciences & Indian Society of Agricultural Biochemists, Fellow Royal Entomological Society, London UK and Scientific





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Board of Studies Raiganj University (2017----), Member
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Member Advisory Committee Cancer Research Advisory
Board, North East Cancer Hospital & Research Institute (2017-
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Dr.Unni visited USA, Germany, Israel, Jordan, France,
Morocco ,UK, Thailand ,Jordan, Singapore , China and UAE
under various exchange program.





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Preface

I am very happy to learn that, the GEMS Arts & Science College is bringing out a series of books written by the faculty in this academic year. The college is occupying a very important position among the colleges in Kerala, the same way the college is having unique standing in both academic and research fronts too. This is because of the excellent management, faculties and the best performances of the students.. I have full confident that in the course of time, and with the sincere commitment and dedication of the faculties , students and with management , the college will attain high level perfection and excellence and became a model college in the state of Kerala

This book entitled " Homo Scientia" had comprehensive research topics in various aspects in the topics of cyber security, biotechnology, microbiology and geology.A brief description about the cybersecurity, the protection of computer set up such as hardware, software data from several threats have been described in the chapter The best practices for deploying and managing IPS network security tools have been explored. The integration of intrusion prevention system (IPS) solutions, adherence to security policies, regular updates, monitoring and the implementation of incident response procedures are considered to be the essential components of a comprehensive network security framework. The risk management in cyber security, various cyber-attack kinds, malware, and some strategies to tackle these attacks are also explained by the authors. A comprehensive overview of the evolution of computer graphics, exploring the advancements in hardware, software, algorithms, and techniques that have propelled the field from its early pixel-based beginnings to the current state of realism etc also described. Optical character recognition has been extensively investigated in the past few years, and has been proven that high recognition rates can be achieved in specific





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application scenarios using some standard and well-studied methods such as neural network, support vector machine (SVM), etc. The possibility of learning an appropriate set of features for designing optical character recognition (OCR) has been investigated

Biotechnology is an interdisciplinary science using modern technologies to construct biological processes in research, agriculture, formulation of pharmaceutical products and other related fields. The better understanding of advances in plant genetic resources, genome modifications, omics technologies to generate new solutions for food security under changing environmental scenarios etc have been discussed in this chapter. The increasing demand for food had a great impact on the agriculture sector to address the various challenges associated with crop productivity. The tremendous advancement in plant research helps in understanding plant biology for sustainable food security, functional ecosystems, crop improvement and human health. One of the sustainable farming techniques is the use of fertilizer at nano level. Nanomaterials that enhance plant nutrition could be considered as an alternative to the conventional chemical fertilizers. one chapter covered the importance of nano fertilizer to enhance metabolic processes in plants and reviewed the concerns in developing nanotechnological methods in the future. Metabolomics has now emerged as a powerful tool for the comprehensive analysis of metabolites within biological systems. One of the chapters provides a review on metabolomics, encompassing its methodologies, applications, potential impact on personalized medicine, and discusses further the need for advancements in analytical technologies. The antifungal activity of mangroves, particularly Rhizophora species are one of the main sources for fungicidal compounds due to the presence of high concentration of phenols. The antifungal activity of Rhizophora species has been elucidated, and could be further utilized as biocontrol agents for fungal disease in agricultural crops. One of the chapters discussed the species identification and its impact on economical and ecological level in the species like Nutmeg, one of the important medicinal plants that had a greater attention, however, it was very difficult to differentiate the sexual identity




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in the seedling stages. But the protein content screening among the studied plantlets had differentiated the sexes in the species as explained by the author.

AI (Artificial Intelligence) or machine intelligence enables farmers to enhance the quality and ensure a quick go-to market strategy for crops, and adoption of these algorithms to improve food industries. Artificial intelligence (AI) has also the potential to revolutionize education, from personalized learning to assessment and grading. Additionally, AI-powered tools can provide greater accessibility to students with disabilities, while also enabling more engaging and interactive content. AI continues to develop and become more prevalent in education, towards responsible and equitable implementation. However the negative and positive part of the AI may also be looked into.

The chapters related to microbiological aspects have also been incorporated in this book. Carbapenem-resistant *A. baumannii* (CRAB), bacteria that cause multi-infections in humans and resistant to multiple drugs too. The study attempted to isolate and characterize the bacterial species from the clinical specimens using biochemical techniques. The enzyme, carbapenemase produced by the bacteria was isolated and determined by different assays. Another study identified the antibacterial, antioxidant and anticancer activities of *Ganoderma lucidum* by various chromatographic techniques. Anticancer activity was also assessed on HeLa cell lines using MTT assay and DPPH assay. In one of the chapters, the author discussed L-asparaginase, one of the widely exploited enzymes for the treatment of acute lymphoblastic leukemia (ALL). Also attempted to isolate and characterize the enzyme from soil samples collected from different locations at Kerala. The study indicated that soils can provide a rich source for L-asparaginase which has got ample application in pharmaceutical industries.

The studies on various geological aspects with respect to different geographical areas in Kerala soil has been included in the book. The vertical geochemical variation and elemental mobility of the lateritic terrain in the Makkaraparamba of Malappuram District, Kerala has been very well investigated. Under extremely oxidizing and leaching conditions, laterite




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soil transformed into a variety of rocks and further developed into stable secondary product in the existing humid tropical and subtropical environments. The hydrogeological conditions in Kumbala- Kaliyar river basin, Kasaragod district, Kerala was assessed by means of Vertical Electrical Sounding (VES). The digital spatial data output of the present study would be much helpful for planning and management of surface and sub-surface water resources of Kasaragod River basin in which the Kasaragod township is centrally located

The contributed chapters in the book written by the faculties of science stream in the light of the recent thinking and developments in the field of science and education. Science & Technology is now dominates almost every field of our activities. In summary, The faculties (Science stream) of GEMS Arts & Science college have made a n excellent attempt to bring about this book "Homo Scientia". covering almost all the important areas from biological sciences to artificial intelligence. Every article has its own merits in both academic and research fronts..I record my grateful appreciation and thanks to the contributors of this book for their untiring efforts.

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GEO- ELECTRICAL RESISTIVITY STUDY OF KASARAGOD WATERSHED, KASARAGOD, KERALA

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ABSTRACT

A watershed describes an area of land that contain a common set of streams and rivers that all drain into a single larger body of water such as larger river, a lake or an ocean. The various methods of Geophysical prospecting used for ground water are the Magnetic, Seismic and Electrical.

INTRODUCTION

A watershed is an area of land that captures rainfall and other precipitation and funnels it to a lake or stream or wetland. Water enters the system as either precipitation directly on the lake surface, runoff from the surrounding land, groundwater, or inflow from upstream lakes. Precipitation falling on the land infiltrates into the ground through percolation to replenish the groundwater. When water accumulates below ground in the spaces between soil and rock, it is called groundwater.

Water leaves the system through evaporation from the land and water surface or through transpiration, a process where moisture is released from plants into the atmosphere. Water also leaves the system through groundwater outflow, consumptive uses (drinking water, industrial/agricultural uses, All of these

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methods ,electrical resistivity prospecting has acquired greatest importance in groundwater investigations and this is mainly due to the large and detectable variation in resistivity values with the quantity of water in a rock. etc.) diversions, and outflows to downstream lakes or rivers.

The resistivity of geological formation in groundwater exploration varies widely and depends on the factors like density, porosity, pore size and shape of the aquifer materials, quality of the water encountered in the aquifer, distribution of water in the rock due to structural and textural characteristics and the temperature of the sub surface environment. Geophysical survey is necessary to ascertain subsurface geological and hydrogeologic conditions and helps to delineate regional hydrogeological features, even pinpoint locations for drilling of boreholes.

Geophysical data provides information on local geological environment such as type and extent of surface material, extent and Degree of weathered mantle, the nature and extent of underlying bedrock, the structural elements etc. that influence ground water occurrence and movement. Geophysical methods of exploration are based on certain physical properties of earth materials. The properties are measured and variations in their values in lateral or vertical directions are made use of for gathering subsurface information. The most important rock properties that are made use of are gravity prospecting, magnetic prospecting, seismic prospecting, electrical prospecting and radiometric prospecting.

Electrical resistivity techniques are based on the response of the earth to flow of electric current. The resistivity of a rock unit depends on its mineral composition and is influenced to a very large extent by the interstitial water content present there in. Electrical resistivity method involves the measurement of surface potential caused by the passage of an electric current. In actual field measurements, a variety of electrode arrangements are used. In actual field measurement, a variety of electrode arrangements or configurations are used, the difference being in the inter-electrode distance and geometry. The most commonly employed configuration are the Wenner and Schlumberger arrangements.

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The basic principle underlying the electrical resistivity method is based on Ohm's law. It states that the known, current (I) flowing through a conductor is directly proportional to the voltage (V) applied across it and is inversely proportional to the resistance (R) of the conductor,

$$I=V/R$$

R, resistance is measured in ohm's when current (I) is in amps and voltage (V) is in volts. But, resistance (R) has got dimensional dependence. It increases with length (L) of the object and decreases with the thickness (A-cross sectional area) of the object.

$$R=\rho L/A$$

Where, ρ is the electrical resistivity or electrical specific resistance (Ohm's-m), which is a characteristics of the material that is independent of the dimension.

Different electrode configuration are being used for measuring the apparent resistivity in the field. The different electrode configuration are Schlumberger, Wenner, Three electrode, Two Electrode, Dipole-Dipole, Square, etc. Out of these, most commonly used are Schlumberger and Wenner. In Schlumberger configuration, the potential electrodes are placed at the center of the electrode array with a small separation. The current electrodes separation is gradually increased during the survey while the potential electrodes remain unchanged.

METHODOLOGY

Study Area

Kasaragod is the northern most district of Kerala, is well known for its beautiful hills and river valleys. Karnataka lies its north and east, while to the south lies Kannur district. The study area consist of Madhur Panchayat, Chengala Panchayath and Kasaragod municipality. Location of the study area is shown in Figure 1. It covers an area of 20.35sq.km bounded by Arabian Sea on the west. It lies between Longitude 74.965° to 75.016° E and Latitudes 12.48° to 12.543°N. The National Highway NH 66 passes through the study area. The study area is well accessible by all season motorable roads and water ways. Southern railway




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connecting Mangalore to Thiruvananthapuram passes through the study area in N-S direction. Kasaragod town ship is centrally located within the study area.

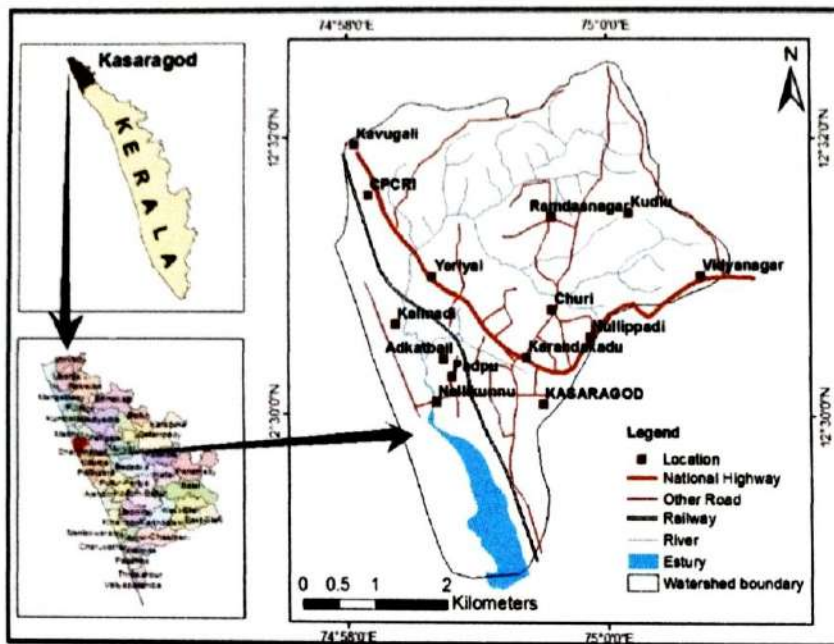


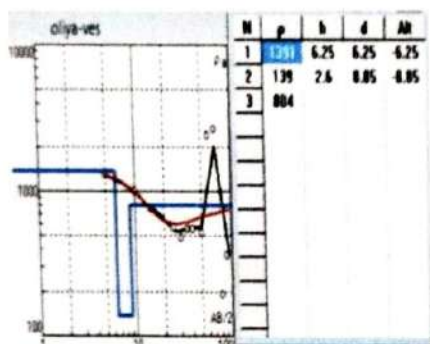
Fig.1 Study area

Electrical resistivity method involved the measurement of surface potential caused by the passage of an electric current. To obtain information of the subsurface in the vertical direction, a technique known as vertical electronic sounding was employed. Schlumberger electrode array has been adopted for conducting vertical electrical sounding in selected location. Apparent resistivity in Ohmm have been calculated using an Excel worksheet. Vertical Electrical Sounding data collected using SSR-MPI from 8 locations was interpreted qualitatively and quantitatively to obtain layered resistivity parameters. Thematic maps of geology, geomorphology, lithology and topographic data were prepared using toposheets and QGIS. The apparent resistivity and $AB/2$ values were plotted on double-log sheet in IPI2Win software. The layered resistivity model obtained in IPI2Win was used to interpret different resistivity layers. The apparent resistivity (U), thickness (h), depth to layer interface (d) were obtained from the layered resistivity model.

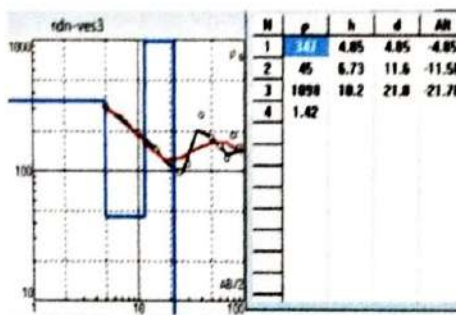


RESULTS AND DISCUSSION

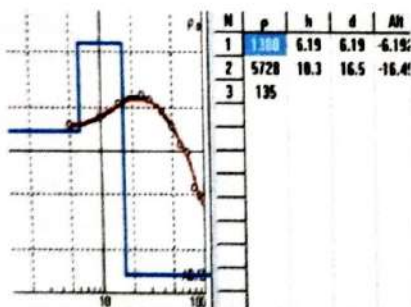
Vertical Electrical Resistivity Survey have been carried out in eight selected location in the study area. Locations are selected in such a way that minimum one location should fall in each litho-units. VES data are interpreted qualitatively and quantitatively. Qualitative interpretation of VES data show multi-layered resistivity profiles for most of the locations (more than three layers). Out of 8 VES curves four location indicates 4 layer type and 3 locations are 3 layer type. Field apparent resistivity curve and interpreted layer details and corresponding apparent resistivity data are given in Fig. 2.



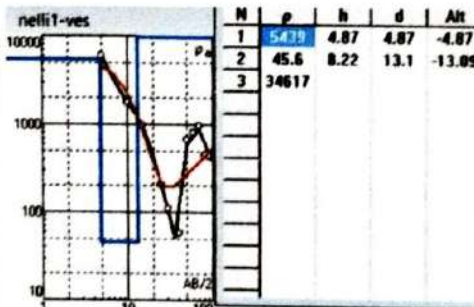
VES 1 (Uliyathaduka)



VES 2 (Ramdasnagar)

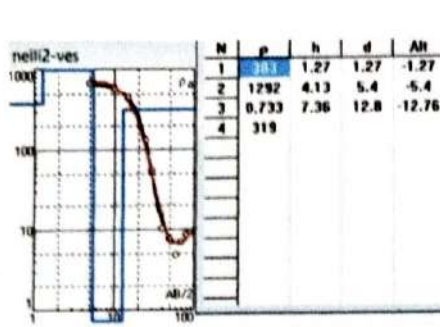


VES 3. CPCRI

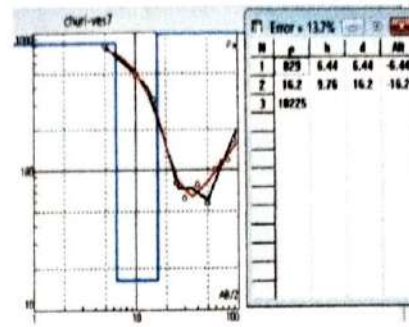


VES 4. Nellikunnu 1

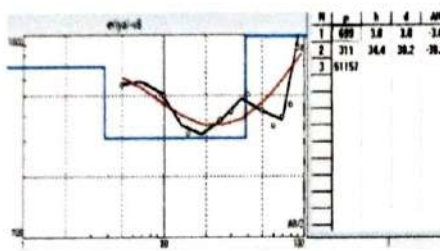




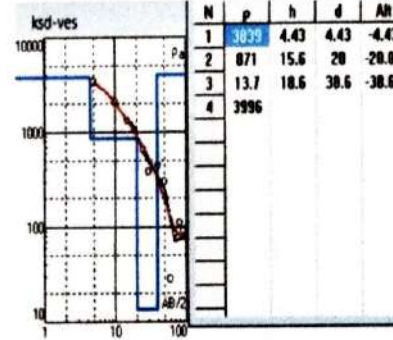
VES 5. Nellikunnu 2



VES 6. Churi



VES 7. Eriyal




VES 8. Government College Kasaragod

Fig. 2 Apparent resistivity of different location

Semi-quantitative interpretation of VES data concludes that majority of sounding curves are H type (VES-1, 4, 6, 7). H-type curves are characterized by first layer of high resistivity followed by a layer of low resistivity and then by a third layer of high resistivity. The resistivity curve QH type is VES-8. VES- 5 represent KH type curve and VES-2 is HK type curve. Apparent resistivity and thickness of layers are tabulated and shown as Table. 1.



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Location				Layer thickness in meters			Apparent Resistivity in Ohm-m.				Upper surface of low resistivity layer
Longitude	Latitude	Location No.	Location Name	First layer	Second layer	Third layer	First layer	Second layer	Third layer	Bed rock	
75.004	12.543	VES1	Uliyath adkka	6.25	2.6		1391	139	804		6.25
74.994	12.525	VES2	Ramdas nagar	4.85	6.73	10.2	347	45	1098	1.42	4.85
74.969	12.529	VES3	CPCRI	6.19	10.3		1380	5728	135		16.5
74.987	12.491	VES4	Nellikunnu 1	4.87	8.22		5439	45.6	34617		4.87
74.967	12.532	VES5	Nellikunnu 2	1.27	4.13	7.36	383	1292	0.733	319	4.13
74.996	12.521	VES6	Churi	6.44	9.76		829	16.2	18225		9.76
74.975	12.519	VES7	Eriyal	3.8	34.4		699	311	51157		3.8
74.013	12.519	VES8	Govt College ground	4.43	15.6	18.6	3839	871	13.7	3996	15.6

Depth wise apparent resistivity data is shown in table 2.

Loc. name	Apparent resistivity in Ohmm.										
	5m	10m	15m	25m	30m	40m	50m	60m	0m	80m	90m
Uliyath adkka	882.42	670.28	513.83	367.27	363.65	358.48	511.99	2404.51	2670.00	195.12	360.43
Ramdas nagar	907.14	559.20	424.79	284.52	279.45	663.14	442.07	153.85	124.15	185.07	153.19
CPCRI	1527.14	1729.87	2113.02	2433.35	2446.48	2050.41	1614.90	1110.13	979.36	549.25	483.61
Nellikunnu 1	4161.76	1243.49	735.99	154.50	90.94	47.96	562.98	800.00	965.84	459.42	442.70
Nellikunnu 2	1092.46	941.92	799.72	234.57	115.35	21.25	16.08	4.72	6.85	8.53	9.06
Churi	1405.11	874.76	566.94	142.32	66.04	82.82	60.45	100.06	113.16	117.98	164.96
Eriyal	235.55	208.24	268.38	311.11	291.56	358.38	297.03	352.30	392.37	446.67	864.34
Govt College ground	1719.39	1074.66	654.05	329.85	264.03	311.59	211.38	28.30	86.21	110.73	90.04

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Spatial variation of apparent resistivity of different layers and thickness of layers are generated by interpolating the location was calculated VES details and are shown in Fig. (3-6).

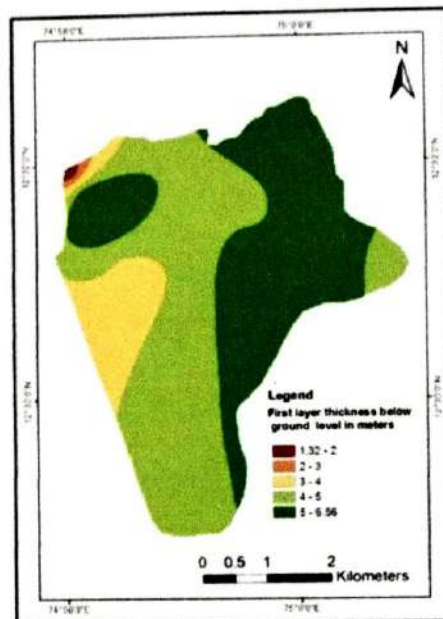
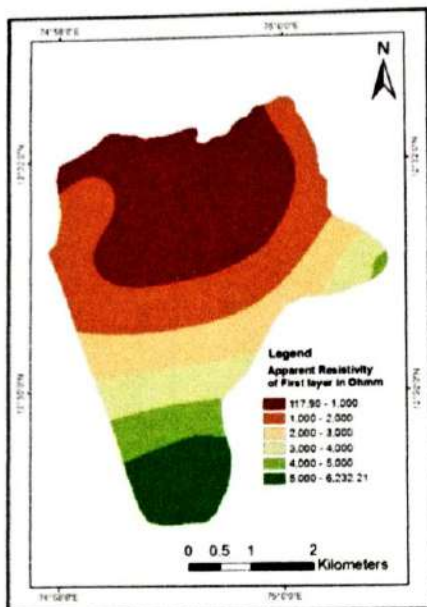


Fig. 3 Apparent Resistivity of first layer Fig. 4 Thickness of first layer

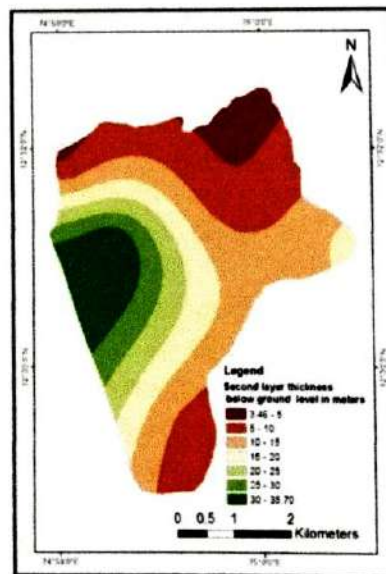
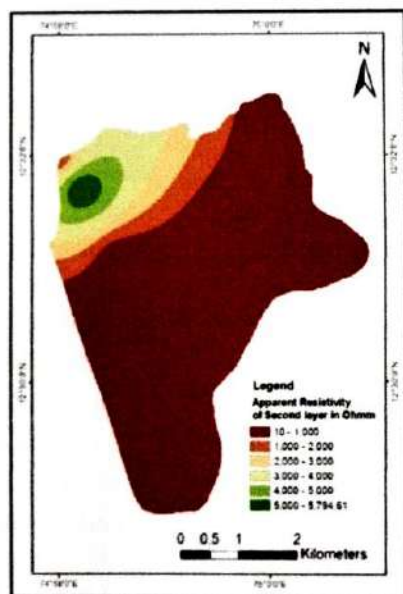


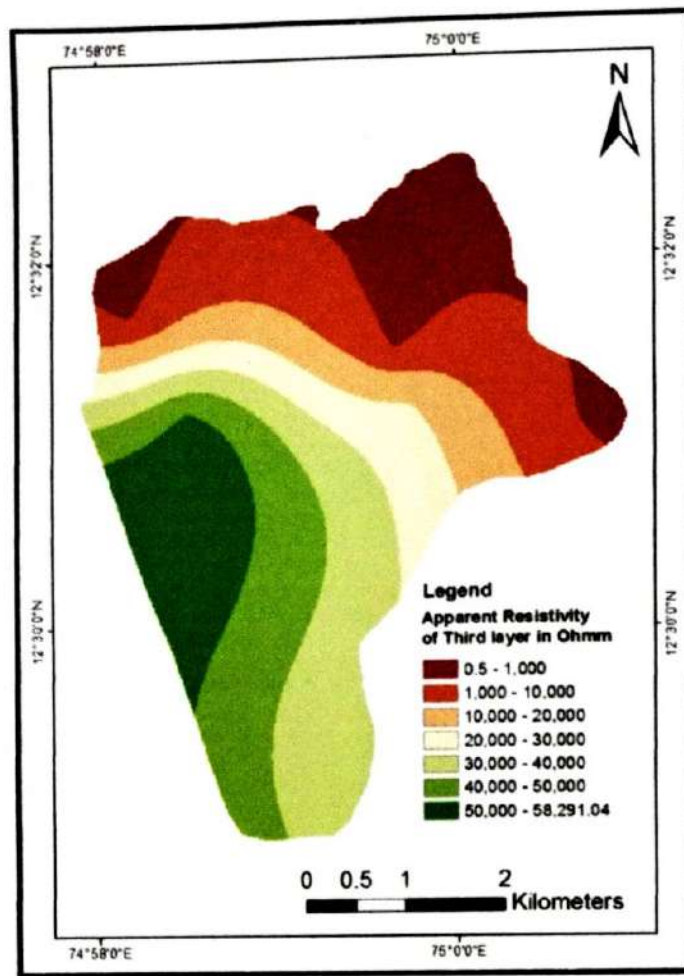
Fig.3 Apparent Resistivity of second layer Fig. 4 Thickness of second layer



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Vertical variation of apparent resistivity at all the eight VES location were compared and shown as Fig.7. Except the location at CPCRI all other location apparent resistivity up to AB/2 spacing of 40 m. shows a similar trend. On evaluation of the general trend of vertical variation of apparent resistivity indicates that 5 to 15m thick laterites and 15 to 45m soft laterite and lithomargic clay and basement rock from 40m depth. CPCRI location apparent resistivity data is attributed to the sandstone clay with lignite intercalation N-S and E-W topographic, water table and upper surface of low resistivity zone profiles Figs. 8 and 9. Profile transects and geology of the study area is shown Fig. 10.



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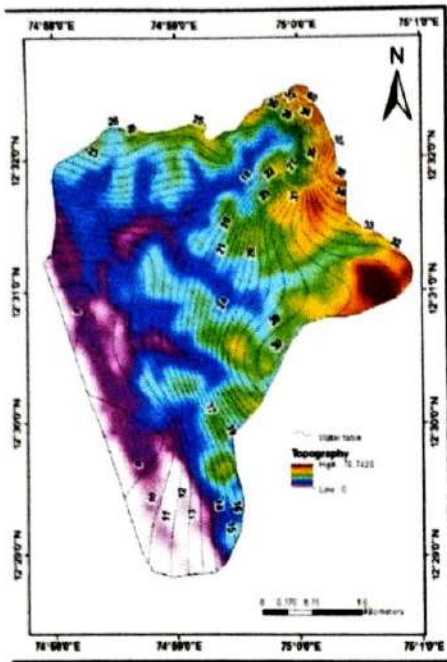


Fig. 9 Water table derived from Resistivity data overlaid on Google earth image.

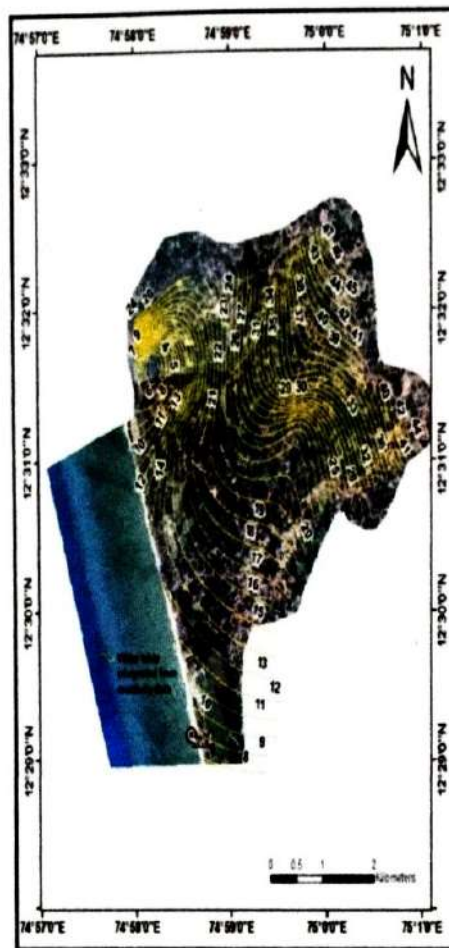


Fig. 10 Profile transect and geology

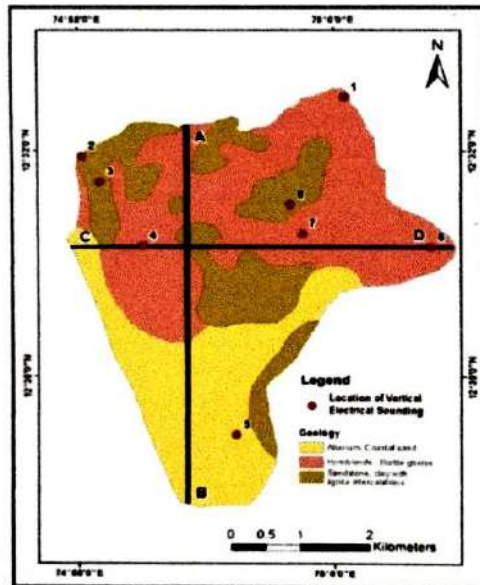


Fig. 10 Profile transect and geology

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CONCLUSION

Coastal watersheds are very sensitive and fragile in both quantity and quality wise. Coastal belt are the most populated tract of any country. Groundwater resources in minor watersheds need to be managed judiciously especially if the watershed is in coastal region. If groundwater recharge and discharge balance is not maintained precisely, there will be great threat of salt water intrusion along coastal part of the minor watersheds. The study area is a small complete watershed which drains to Arabian Sea. All minor watersheds in Kasaragod districts are coastal watersheds in which river originate from low reach of midland area and debouches to Arabian Sea. Judicious watershed management practices are required to be performed in these areas. Different interlayered aquifer system in the coastal area need to be deciphered and analysed using various geophysical method. The digital spatial data output of the present study will be much helpful for planning and management of surface and sub-surface water resources of Kasaragod River basin in which the Kasaragod township is centrally located. Delineation of water table using geoelectrical data and comparison of the same with observed field water table data is the original contribution of this study.




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