

**DEPARTMENT OF GEOLOGY**

**ALAGAPPA UNIVERSITY**

State University | A+ Grade by NAAC (CGPA : 3.64) in the 3rd Cycle | Category -  
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**KARAIKUDI - 630 003, TAMIL NADU, INDIA**

# De Rerum Natura

(On the Nature of Things)

**E-MAGAZINE**



Vaidal Dr. S.M. Abegappa Chettyar

Academic Year 2021 – 2022, Issue - 4





தலைவர் கி. வி. சுகுமார் தலைவர்



# Head of the Department Desk



**Dr. V. SUGUMAR**  
ASSISTANT PROFESSOR & HEAD I/C

*As the Head of this prestigious Department, I am proud and happy to see the success and growth of our E-magazine. It is a testament to the passion, talent, and originality of our students, and a reflection of the diverse perspectives, experiences, and voices that make our Department a vibrant and dynamic community.*

*Over the years, our Department has strived to provide a nurturing environment that fosters holistic development and prepares students to become leaders in their fields of study. We believe that education is not just about acquiring knowledge, but also about cultivating critical thinking, empathy, and a sense of responsibility to society.*

*I extend my sincere congratulations to the editorial team and all those who have contributed to this E-magazine. Your efforts have resulted in a beautiful compilation of literature in different languages, photography, artwork, and overall creativity that truly captures the essence of our Department.*

*May this E-magazine inspire you to reach new heights and serve as a reminder of the incredible potential that lies within each of us.*

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# Editorial Desk



*With great pleasure, I extend my warm greetings through the pages of our Department e-magazine, **Lapides Loquuntur (The Stones Speak)**, a beautiful embodiment of our Department spirit.*

*At the Department of Geology, we believe that education goes beyond textbooks and lecture halls. Each student has unique talents, passions, and interests, and we are dedicated to fostering an environment that encourages their exploration and growth. We encourage our students to pursue their passions in various areas, whether sports, arts, music, theater, debates, community service, or anything else. Engaging in extracurricular activities helps them excel in diverse fields and contributes significantly to their personal development.*

*In today's digital age, it is essential to embrace innovative ways of sharing knowledge and ideas. Our Department E-magazine serves as a virtual platform for expressing our thoughts and learning from one another. I encourage all students and faculty members to actively participate in and contribute to this enriching endeavor.*

*I express my heartfelt appreciation to the editorial team and everyone involved in creating **Lapides Loquuntur (The Stones Speak)**. Your hard work and dedication have resulted in a remarkable collection of stories, articles, and creative expressions that truly capture the spirit of our Department community.*

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நீ முழுவதுமாக அறிந்து கொள்...!!**



**நாளை உனக்கான நாளாகவும்  
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வேண்டிய அவசியமும் இல்லை...!!**



**திரு. ச. சதீஷ்**  
M.Phil. ஆரய்ச்சி மாணவர்



## எது பாரம்பரியம்

அன்றைய காலம் ஆடையில் தொடங்கிய  
பாரம்பரியத்தை இன்றைய இளைய சமூகம்  
பாடை ஏத்திச் செல்வதைச் சொல்லவா  
இல்லை!

சாதிக்க கூட ஜாதித் தேவை என்கிறதே அதைச்  
சொல்லவா இல்லை!

சம உரிமை கொடுத்து சமையலறையில்  
இருந்த பெண்களை சந்தி சிரிக்க வைக்கும்  
இன்றைய அரசியலைப் பற்றிச் சொல்லவா  
இல்லை!

படிப்பிலும் பாகுபாடு காட்டும் பாவப்பட்ட  
நிலையைச் சொல்லவா!

பல ஒளியாண்டு கடந்து செல்லும்  
சந்திராயனைப் பற்றிப் பெருமை  
பேசிக்கொள்கிறோமே! மறந்து விடாதீர்கள்  
இன்றும் மனிதக் கழிவை மனிதனே அகற்றும்  
மானங்கெட்ட பாரம்பரியம் உண்டென்று  
பாரம்பரியம் பாதுகாக்கலாம் ஆனால் இங்கு.  
அதிலும் பாகுபாடு தானே! பாவப்பட்ட  
ஜனங்கள் இந்த பாலாப்போன பூமியில்  
பிறந்ததை விட வேறு பெரிய பாரம்பரியம்  
என்ன இருந்திடப் போகிறது.

திரு. மூ. விக்னேஸ்மாரி  
முதலாம் ஆண்டு பயன்பாட்டு  
புவிஅமைப்பியல் மாணவர்





**ENGLISH**

**Right now, I'm enjoying myself lightly. What would you say best describe your emotions?**



**Maybe it doesn't go into enough detail.**

**Both here on Earth and in heaven, we are regret-free and at peace as calm as the wind. I'm prepared to handle everything that comes my way. I'm not sure why I can't seem to get it out of my thoughts, why I'm stuck in your spell, or why I miss you so much. On my behalf, just pay attention to your heart and let the rain to call to you.**

**That does our little life need...**



**Ms. S. BANGARU PRIANGA  
Ph.D., RESEARCH SCHOLAR**

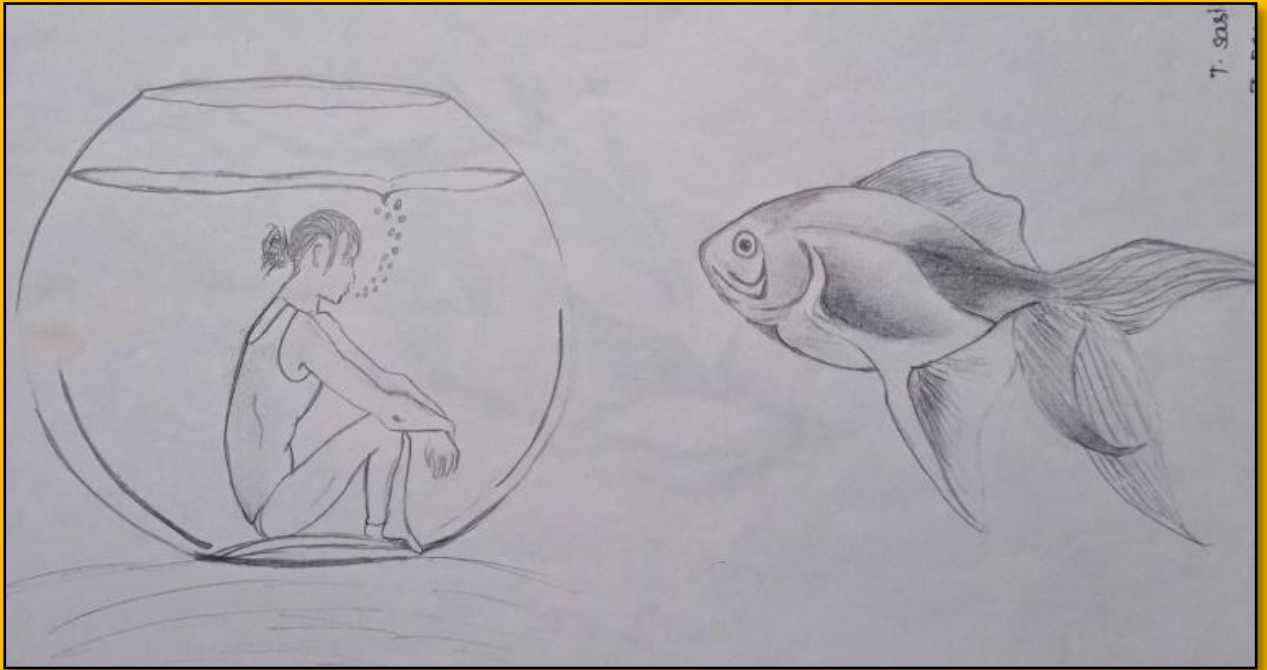
A close-up photograph of a brick wall. The bricks are painted in two colors: teal and pink. A large, semi-circular shape is painted in pink, starting from the bottom left and curving towards the top right. The rest of the wall is painted in teal. The word "ART" is written in white, bold, serif capital letters on the pink semi-circle. The letters are stacked vertically, with "AR" on top and "T" below it. The background is a brick wall with a teal and pink color scheme. A large pink semi-circle is painted on the wall, and the word "ART" is written in white, bold, serif capital letters on the pink area.

**AR  
T**



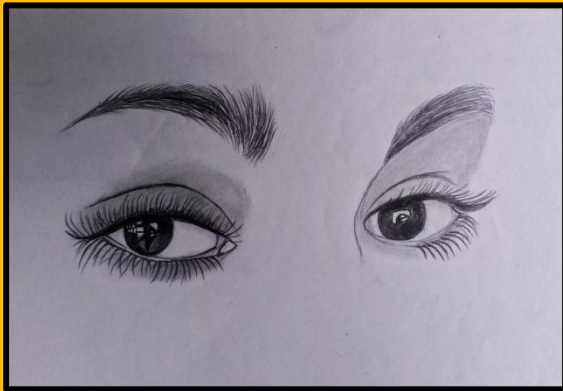
**Mr. T.SASIKUMAR**  
**1<sup>st</sup> M.Sc., APPLIED GEOLOGY**





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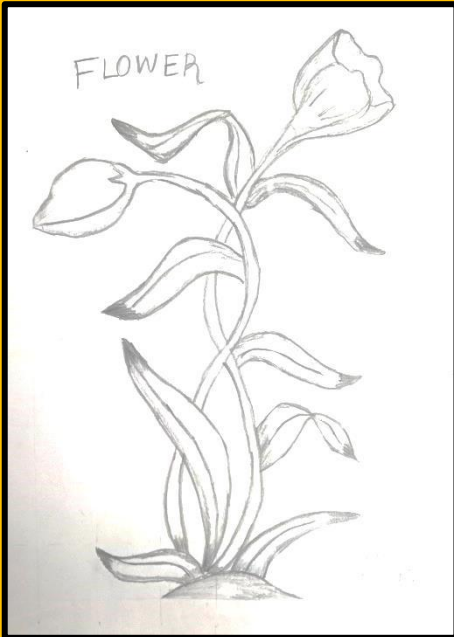
MOTHER TERESA

Art By,  
M.M. Divya

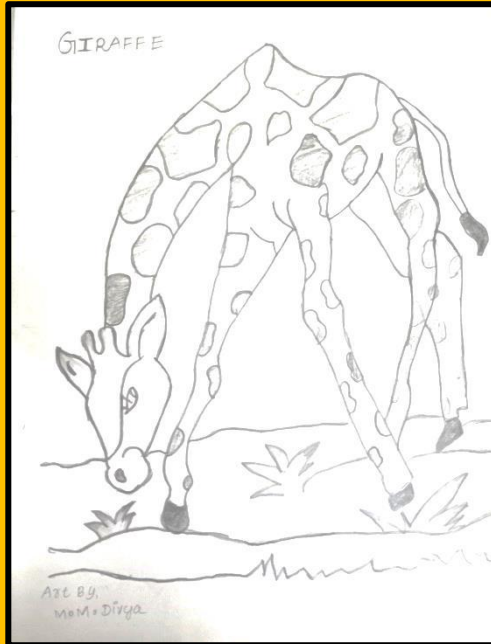


AMBEDHKAR

Art By,  
M.M. Divya

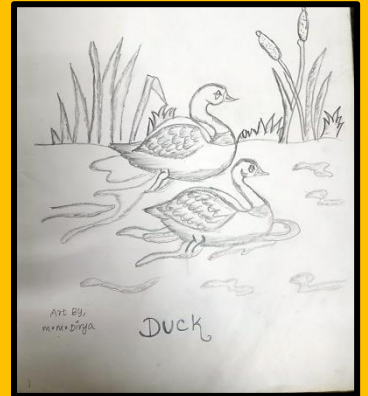


FLOWER



GIRAFFE

Art By,  
M.M. Divya



Duck



BEAR

Art By,  
M.M. Divya



MICKY  
MOUSE

Art By,  
M.M. Divya

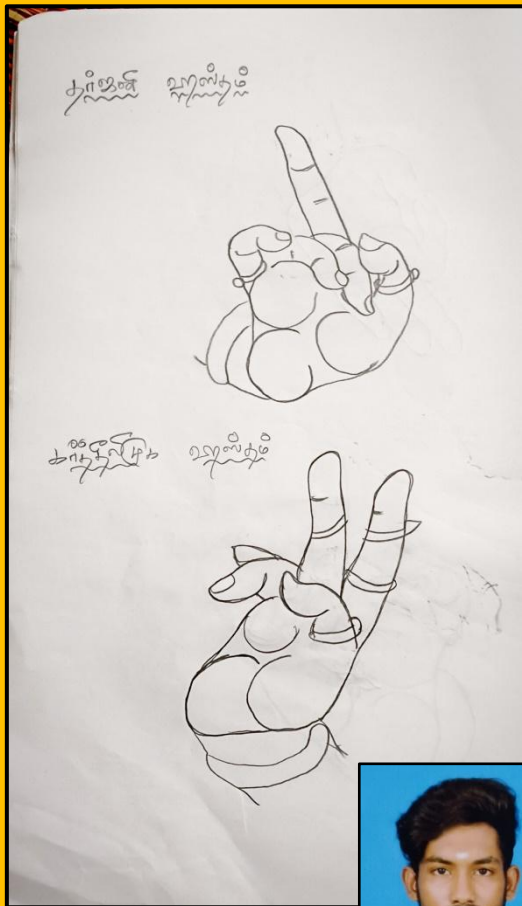
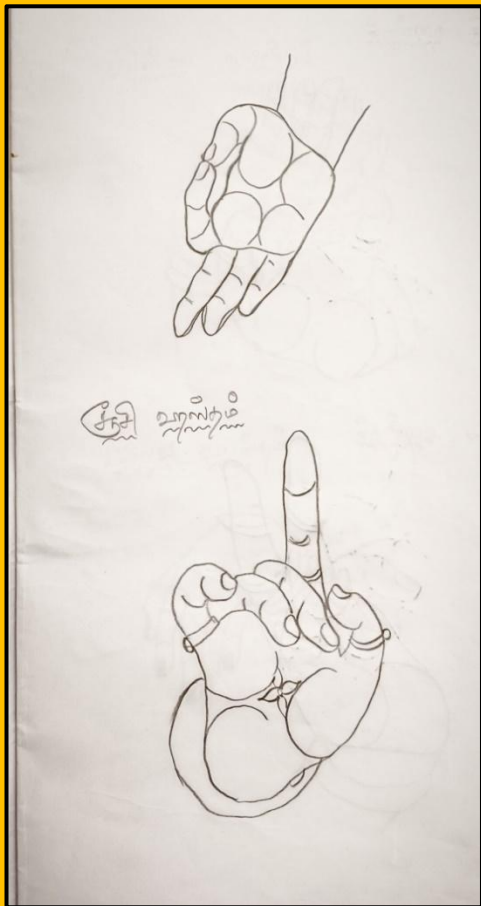
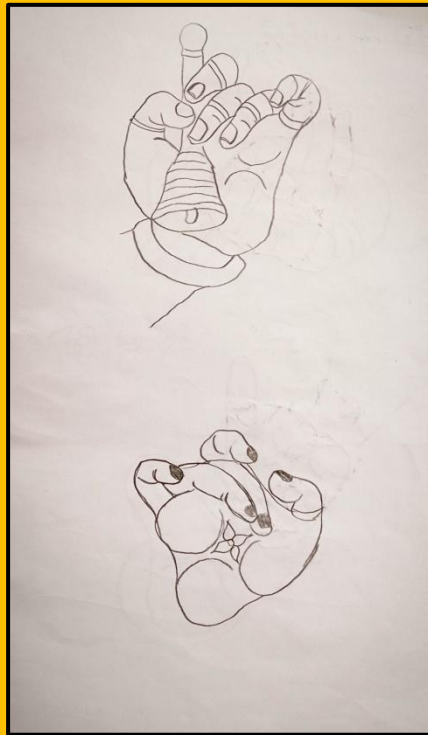
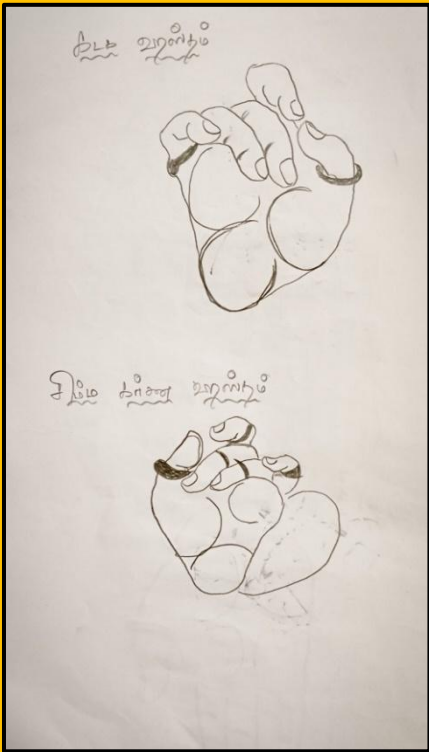
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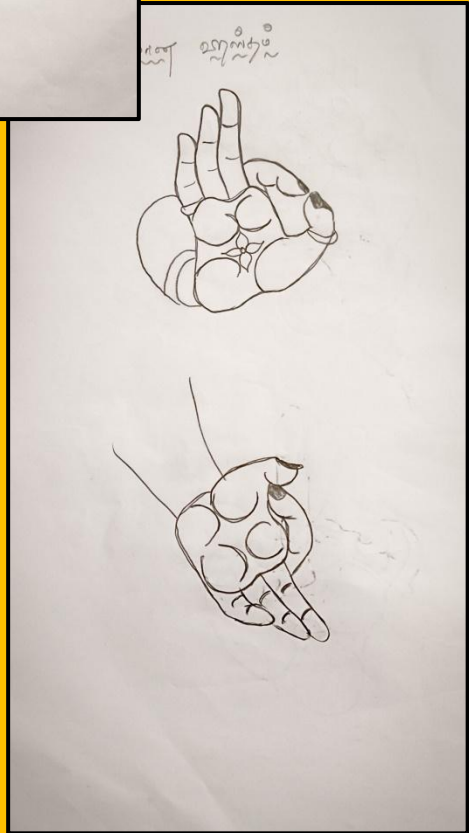
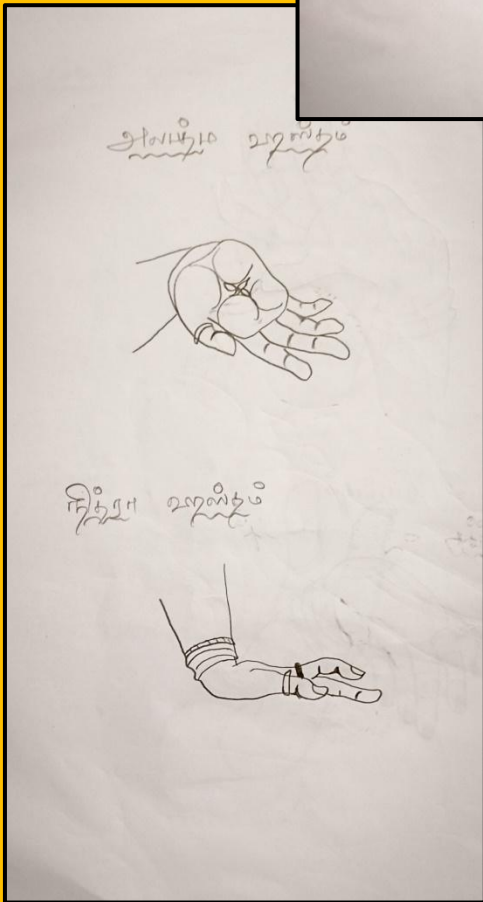


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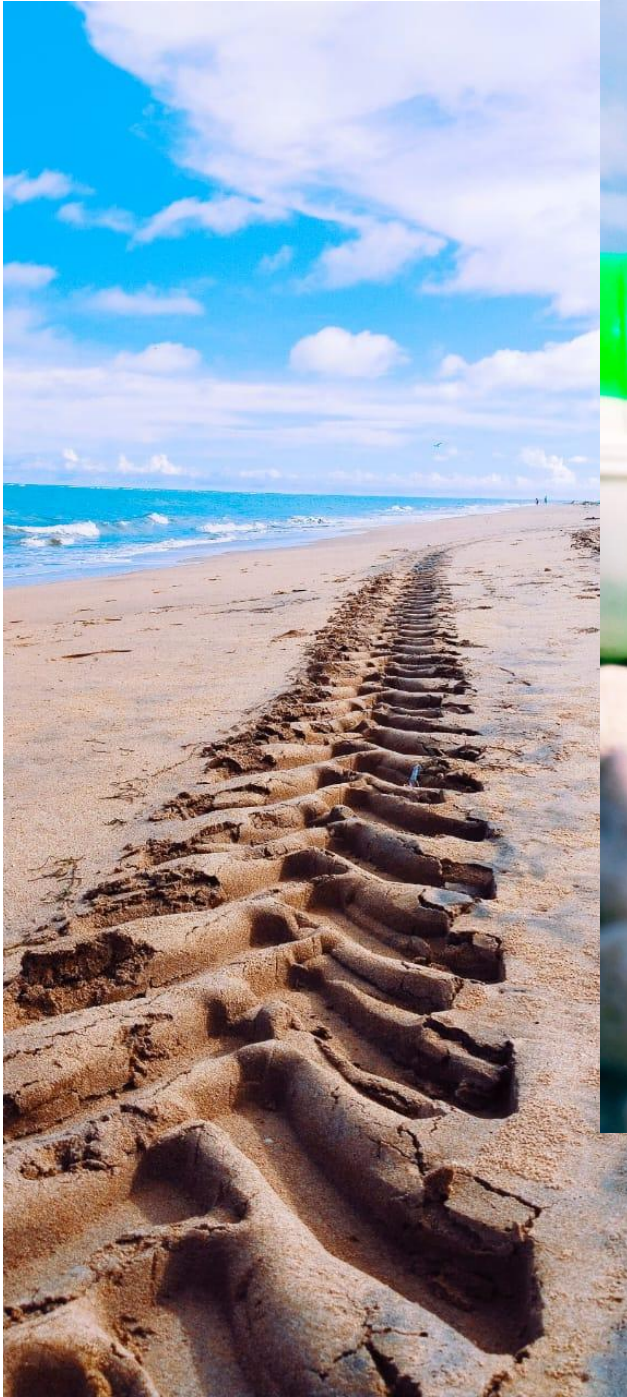


**Mr.S. KATHIRVELAN**  
**Ist. M.Sc., APPLIED GEOLOGY**



A textured wall with a grid pattern, overlaid with a large pink semi-circle and a teal semi-circle. The word "PHOTOGRAPHY" is written in white, bold, serif capital letters across the center of the pink semi-circle.

**PHOTOGRAPHY**



**Dr. V. PERUMAL**  
TEACHING ASSISTANT

A close-up photograph of a brick wall. The bricks are painted in a vibrant, multi-colored pattern. A large, semi-transparent pink circle is overlaid on the right side of the image, partially covering the bricks. The word "EVENTS" is written in a white, serif font across the center of the pink circle.

# EVENTS

# GEOLOGY FIELD WORK 2021 – 2022- SALEM IN AND AROUND



**KANJAMAL  
AI**



# GEOLOGY FIELD WORK 2021 – 2022- SALEM IN AND AROUND





A close-up photograph of a brick wall. The bricks are painted in a vibrant, multi-colored pattern. A large, semi-transparent pink circle is overlaid on the wall, centered horizontally and extending from the middle to the bottom of the frame. The word "PUBLICATIONS" is written in bold, white, sans-serif capital letters across the center of the pink circle.

# **PUBLICATIONS**

*Journal of Climate Change*, Vol. 8, No. 2 (2022), pp. 59-67.  
DOI 10.3233/JCC220014

## **Spit Evolution and Shoreline Changes Along Manamelkudi Coast Using Geo-Spatial Techniques and Statistical Approach**

**Premkumar, M.<sup>1</sup>, Kongeswaran, T.<sup>1\*</sup>, Sivakumar, K.<sup>1</sup>, Muruganantham, A.<sup>1</sup>,  
Muthuramalingam, R.<sup>1</sup>, Chandramohan, S.<sup>2</sup> and Vasanthavigar, M.<sup>2</sup>**

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*Received March 13, 2022; revised and accepted April 2, 2022*

**Abstract:** The historical shoreline changes from 1980 to 2020 along the Manamelkudi coast is studied using toposheet, satellite time-series Landsat data, and observed data. An attempt is made to recognise possible factors which are responsible for shoreline changes and spit growth at south Manamelkudi coast (Palk Strait), Eastern part of Pudukkottai district, Tamilnadu. During 1980–2020, the regions showed distinct spatio-temporal variability, which is discussed in relation to spit evolution and shoreline changes. The study also generated a long-term (1980-2020) shoreline change statistics (EPR, LRR, SCE and NSM, WLR) using the Digital Shoreline Analysis System (DSAS) at every 150 m interval for the Manamelkudi coast covering 42 km, identified the erosion and accretion and divide the shoreline into different classes of erosion and accretion. Identified lengths of shoreline with high erosion, low erosion, stable, low accretion and high accretion are, respectively, based on LRR. The results indicate that spit evolution is predominant along the Manamelkudi coast, with the highest percentage of erosion and accretion.

**Keywords:** Spit; Shoreline change; DSAS; Manamelkudi coast; Erosion; Accretion.

# Agriculture Drought Management in Ramanathapuram District of Tamil Nadu, India

**K. Sivakumar<sup>1\*</sup>, K. Prabakaran<sup>1</sup>, P.K. Saravanan<sup>2</sup>, S. Muthusamy<sup>3</sup>,  
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*Received January 6, 2022; revised and accepted February 2, 2022*

**Abstract:** Drought is one of the recurring features of Indian agriculture, especially in the rain fed areas. It affects not only the national food security but also causes miseries to human life and live stock. The study area, i.e., Ramanathapuram district of Tamilnadu, India (Latitude 9°40' and Longitude 78°70') has been affected consecutively for the last three years from 2015 to 2018 by drought, due to the failure of rainfall of northeast and southwest monsoons. So, the economic status of the area has declined due to the drought and the people from this district have migrated to other districts to improve their socio-economic status. This district has seven taluks, eleven blocks and four hundred villages. Major physiography units of the district are vast coastal plain, adjacent alluvial plain and a small area of buried pediments. The predominant geological formations are recent alluvium, and laterite followed by mio-pliocene Cuddalore Sandstone, upper cretaceous calcareous sandstone and proterozoic basement rocks. The total thickness of sedimentary rocks may be upto 3000 metre. The shallow aquifer in the district is severely affected by sea water intrusion and the inland salinity of marine sedimentary formations. Since the shallow aquifer is saline, paddy cultivation practices are generally being done through rain fed lake irrigation. According to the Central Ground Water Board report, the deeper groundwater aquifer in this district would give

## Article

# Hydrogeochemical Survey along the Northern Coastal Region of Ramanathapuram District, Tamilnadu, India

Sivakumar Karthikeyan <sup>1</sup>, Prabakaran Kulandaisamy <sup>1</sup>, Venkatramanan Senapathi <sup>2\*</sup>, Sang Yong Chung <sup>3</sup>, Kongeswaran Thangaraj <sup>1</sup>, Muruganantham Arumugam <sup>1</sup>, Sathish Sugumaran <sup>1</sup> and Sung Ho-Na <sup>4</sup>

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**Abstract:** Ramanathapuram is a drought-prone southern Indian district that was selected for conducting a hydrogeochemical study. Groundwater samples from 40 locations were collected during January 2020 (pandemic interdiction according to COVID) and January 2021. The hydrogeochemical properties of the groundwater samples were evaluated and compared with drinking water regulations to assess their water quality. The order of cation dominance was as follows:  $\text{Na}^+ > \text{Ca}^{2+} > \text{K}^+ > \text{Mg}^{2+}$  in January 2020 and  $\text{Na}^+ > \text{Ca}^{2+} > \text{Mg}^{2+} > \text{K}^+$  in January 2021 with respect to the mean value. The order of anion dominance was as follows:  $\text{Cl}^- > \text{HCO}_3^- > \text{SO}_4^{2-} > \text{NO}_3^- > \text{F}^-$  in January 2020 and  $\text{Cl}^- > \text{SO}_4^{2-} > \text{HCO}_3^- > \text{NO}_3^- > \text{F}^-$  in January 2021 with respect to the mean value. In the study area, the southern coastal region was identified as a groundwater-polluted zone through spatial analysis based on all analysis results. The irrigation water quality was analyzed using various calculated indices, such as Na% (percent sodium), SAR (sodium absorption ratio), PI (permeability index), MgC (magnesium risk), RSC (residual sodium concentration), and KI (Kelly ratio), demonstrating the suitability of the groundwater for irrigation in most parts of the study area. This was also confirmed by the Na% vs. EC Plot, USSL, and Doneen's Plot for PI. In addition, the WQI results for drinking water and irrigation confirmed the suitability of the groundwater in most parts of the study area, except for the coastal regions. The dominant hydrogeologic facies of  $\text{Na}^+\text{-Cl}^-$ ,  $\text{Ca}^{2+}\text{-Mg}^{2+}\text{-SO}_4^{2-}$ , and  $\text{Ca}^{2+}\text{-Mg}^{2+}\text{-Cl}^-$  types illustrated by the Piper diagram indicate the mixing process of freshwater with saline water in the coastal aquifers. Rock–water interaction and evaporation were the main controllers of groundwater geochemistry in the study area, as determined using the Gibbs plot. Ion exchange, seawater intrusion, weathering of carbonates, and the dissolution of calcium and gypsum minerals from the aquifer were identified as the major geogen-

**Citation:** Sivakumar, K.; Prabakaran, K.; Venkatramanan, S.; Chung, S.Y.; Kongeswaran, T.; Muruganantham, A.; Sathish, S.; Ho-Na, S. Hydrogeochemical Survey along the Northern Coastal Region of Ramanathapuram District, Tamilnadu, India. *Appl. Sci.* **2022**, *12*, 5595. <https://doi.org/10.3390/app12115595>

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# Issues of coastal groundwater contamination

Sivakumar Karthikeyan<sup>a</sup>, Prabakaran Kulandaisamy<sup>a</sup>, Venkatramanan Senapathi<sup>b</sup>, Kongeswaran Thangaraj<sup>a</sup>, Muruganantham Arumugam<sup>a</sup>, Selvam Sekar<sup>c</sup>, and Paramasivam Chellamuthu Ranganathan<sup>d</sup>

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## 1 Introduction

One of the most abundant chemical substances on Earth, covering two-thirds of the surface, is water, and it is one of the most widely used precious resources (Ramesh and Elango, 2014). Only 2.4% of the total amount of water available in the world is distributed on the continental crust, of which hardly 0.3% to 0.5% is available as freshwater for human use, so prudent management is crucial (Ganesh and Kale, 1995). Groundwater has become an important resource in recent decades as its use for drinking, irrigation, and industrial purposes has increased (Agastheeswaran et al., 2021). Rapid population growth and acceleration of modernization have led to a massive increase in demand for freshwater in recent decades (Ozler, 2003). Because groundwater is a dynamic resource, it is changing both quantitatively and qualitatively (Muruganantham et al., 2021). In response to rising costs and declining groundwater quality, the importance of groundwater as an alternative water supply is increasingly recognized (Prabakaran et al., 2020; Sivakumar et al., 2021). Increasing water demand has led to increased groundwater extraction in sensitive areas such as coastal areas, where aquifers may be exposed to seawater intrusion, resulting in deteriorating quality (Selvam et al., 2021).

A coastal aquifer is particularly vulnerable to seawater intrusion and degradation because it is in direct contact with the sea on at least one side of its perimeter and is also exposed to likely urban, industrial, or agricultural pollution from the mainland (El Moujabber et al., 2006). This is a widespread problem in many places around the world. WHO (2011) states that 80% of all waterborne diseases are human-borne. Once groundwater is poisoned, it is impossible to restore its quality by removing contaminants at the source. In addition, most local industries discharge their wastes directly into the ocean or rivers without concern for the impact of these pollutants on shallow coastal aquifers and aquatic life. The availability of



## Role of GIS in deciphering hydrogeochemical processes and quality in Pudukottai district, Tamil Nadu, India

Muruganatham Arumugam<sup>1</sup> · Sivakumar Karthikeyan<sup>1</sup> · Prabakaran Kulandaisamy<sup>1</sup> · Kongeswaran Thangaraj<sup>1</sup> · Venkatramanan Senapathi<sup>2</sup> · Bangaru Priyanga Sundaram<sup>1</sup> · Agastheeswaran Vellalkannu<sup>1,3</sup> · Perumal Velmayil<sup>1</sup>

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### Abstract

This study addressed hydrogeochemical characterization and groundwater quality degradation for drinking and irrigation purposes in Pudukottai district using a geographic information system. Eighty-seven groundwater samples were collected from the bore and dug wells during the pre and post-monsoon season in 2019. The order of mean ionic abundance is as follows  $\text{Cl}^- > \text{HCO}_3^- > \text{Na}^+ > \text{SO}_4^{2-} > \text{Mg}^{2+} > \text{Ca}^{2+} > \text{K}^+$  (325.5 > 182.2 > 181.4 > 83.2 > 51.1 > 35.8 > 9.1 > 8.6 > 0.9 > 0.3) and  $\text{Cl}^- > \text{Na}^+ > \text{HCO}_3^- > \text{SO}_4^{2-} > \text{Mg}^{2+} > \text{Ca}^{2+} > \text{K}^+$  (415.7 > 230.3 > 198.2 > 82.9 > 53.8 > 43.4 > 14.9) in both seasons. Analytical results are presented in Piper, Gibbs,  $\text{Na}\%$  vs. EC, USSL and PI plots used to evaluate the hydrogeochemical processes. The interaction between rock water and evaporation processes leads to variations in the hydrogeochemistry of the study area during pre and post monsoon. Almost 15% of the groundwater samples were not suitable for drinking according to the standard, which is common in the south-eastern region of the study area. From the results of  $\text{Na}\%$ , SAR, RSC,  $\text{MgC}$  and KR, majority of the groundwater samples were suitable for irrigation purpose. The higher concentrations of EC, TDS,  $\text{Cl}^-$  and  $\text{Na}^+$  values were found in the southern region, which is due to seawater intrusion caused by excessive pumping in the coastal regions. Drinking water quality index (DWQI) and irrigation water quality index (IRWQI) are calculated to determine the suitability of groundwater for drinking and irrigation purposes. Scatter plots show that the dissolution of carbonate minerals by the reverse ion exchange process increases the ions content of groundwater. In addition, statistical analysis of correlation matrix, PCA and cluster analysis were carried out to understand the relationship between the parameters and factors affecting hydrogeochemistry. However, the study concludes that most of the district is suitable for both drinking and agricultural purposes and can be used for sustainable growth. It is also recommended that, artificial recharge structures be introduced to improve groundwater quality in this region.

**Keywords** Hydrogeochemical process · Groundwater quality · DWQI · IRWQI and GIS

### Introduction

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## **Study of Palaeoclimate Reconstruction Using Sediments and Micropaleontology in the Karankadu Estuary, Ramanathapuram District, Tamil Nadu, India**

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**Abstract:** The study of sedimentary characteristics and paleontology is very useful in assessing the past environment of a study area. The Karankadu estuary study area is considered to be one of the most ecologically diverse in the Ramanathapuram district of southern India. The sedimentological and recent foraminiferal assemblages were studied using a drill core from the estuary. Foraminifera analyses, grain size analyses, heavy mineral analyses and XRD maps were prepared for the present study. A total of 30 species were identified from the following suborders: *Rotalina*, *Lagenina*, *Mollusca*, *Miliolina*, and *Textularina*. Grain size analysis identified the substrate as mostly silty clay. Heavy mineral analysis identified 90% of light minerals and 10% of heavy minerals. In XRD analysis, quartz and feldspar appeared as major minerals and garnet, zircon, hypersthene, magnetite and ilmenite as minor minerals. The present study shows that the environment is more diverse due to its quiet character and less responsive to hazardous events such as floods and waves.



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