Data Article

Sediment textural characteristics and elemental distribution in the core sediments, Pullivasal and Kurusadai Island, Gulf of Mannar, Southeast coast of India

P. Saravanana, S. Krishnakumar, P. Parthasarathy, Judith D. Silva, D. Pradhapa

Department of Geology, University of Madras, Guindy Campus, Chennai 600025, India
Department of Energy, University of Madras, Guindy Campus, Chennai 600025, India

A R T I C L E   I N F O

Article history:
Received 7 September 2017
Received in revised form 13 September 2017
Accepted 26 September 2017
Available online 2 October 2017

Keywords:
Sediment texture
Coral islands
Gulf of Mannar
Core sediments
Elemental distribution

A B S T R A C T

Two core samples were collected in order to assess the textural characteristics and elemental distribution of the sediments, from the lagoonal environment of Pullivasal and Kurusadai island, Gulf of Mannar, Southeast coast of India. The distribution of the organic matter and calcium carbonate is chiefly controlled by the coral debris, shell fragments and mangrove litters. The elemental distribution is controlled by natural process and other trace elements are controlled by anthropogenic land based activities.

© 2017 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

Specifications Table

Subject area Sedimentology, Geochemistry
More specific subject area Sediment geochemistry
Type of data Table and Figure

* Corresponding author.
E-mail addresses: saravananpanchatcharam@gmail.com (P. Saravanan), coralkrishna@yahoo.co.in (S. Krishnakumar), petrosarathy@gmail.com (P. Parthasarathy), judijudes@yahoo.co.in (J.D. Silva), pradhap78kdp@gmail.com (D. Pradhap).

http://dx.doi.org/10.1016/j.dib.2017.09.070
2352-3409/© 2017 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).
Value of the data

- The depositional environmental condition and natural disaster events can be studied through sediment textural analysis.
- The relationship between elemental concentration, calcium carbonate (CaCO3) and organic matter (OM) content is helpful to identify the mode of elemental transport in the coral reef environment.
- The coral rubbles and lithoclastic sediments are explaining the intensity of eolian and marine process during the past.

1. Data

The sampling location was chosen from Pullivasal and Kurusadai Islands of Gulf of Mannar (Fig. 1). Tables 1 and 2 is representing the sediment textural characteristics, CaCO3, Organic matter and elemental distribution of the core sediments of Pullivasal and Kurusadai Islands of Gulf of Mannar. The vertical distribution of the sediment textural characteristics, CaCO3, Organic matter and the elements were plotted in Figs. 2–4.

2. Experimental design, materials and methods

2.1. Sample collections

Two core samples were collected using PVC pipe and the retrieved core samples are transported to Department of Geology, University of Madras and keep the both cores at −5 °C. The total length of the cores is 50 and 40 cm respectively. The sub sample was separated at every 2 cm interval. The coarse grained coral rubbles were removed from a subsample manually.

2.2. Elemental analysis, textural characteristic studies, Determination of Organic matter and calcium carbonate (OM and CaCO3)

The textural characteristics of the sediments were clearly suggested the dominancy of fine fractions in the core sediments. This observation primary due to persistence of calm environment in the lagoon. The core sediments are dominated by sandy clay in Pullivasal Island and sandy silt in Kurusadai Island. Organic matter (OM) was determined by exothermic heating and oxidation with potassium dichromate and concentrated H2SO4. The excess amount of dichromate titrated with 0.5 N ferrous ammonium sulfate solution [3]. Calcium carbonate (CaCO3) and trace element analyses were performed as suggested by Loring and Rantala [2]. The maximum concentration of calcium carbonate in the lower part of the core may be due to the presence of small coral rubbles and coral sand. The same trend was also observed in organic matter content. The enrichment of organic matter in the down core region is chiefly derived from mangrove litters and decomposition sediment associated...
**Table 1**

Elemental concentration, textural characteristics of sediment, Calcium carbonate (CaCO₃) and Organic matter (OM) level of core sediments, Pullivasal Island, Gulf of Mannar, Southeast coast of India.

| S.no | Subsample Interval | Fe    | Mn    | Pb    | Zn    | Ni    | Cr    | Cu    | Co    | Sand | Clay | Silt | CaCO₃ | OM   |
|------|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|-------|------|
| 1    | 0–2                | 36,650| 450   | 115   | 90.48 | 165   | 408   | 41.7  | 19.9  | 13.40| 68.5 | 18.1 | 14.6  | 23.05|
| 2    | 2–4                | 16,460| 378   | 47    | 146.8 | 95.6  | 386.2 | 48.7  | 14.3  | 10.13| 53.4 | 36.7 | 13.1  | 17.42|
| 3    | 4–6                | 58,220| 448   | 92    | 116.46| 222   | 1077.8| 45.7  | 32.5  | 7.82 | 59.5 | 32.7 | 6.5   | 13.45|
| 4    | 6–8                | 60,340| 438   | 87    | 170.91| 109.6 | 1359.3| 42.7  | 31.4  | 5.81 | 55.9 | 38.2 | 10.2  | 10.00|
| 5    | 8–10               | 51,580| 404   | 75    | 120.22| 146.1 | 1269.4| 44.4  | 26.8  | 5.19 | 53.4 | 41.4 | 9.7   | 8.93 |
| 6    | 10–12              | 64,790| 498   | 75    | 115.05| 173.1 | 960.1 | 51.8  | 26.2  | 5.09 | 62   | 32.9 | 9     | 8.76 |
| 7    | 12–14              | 21,140| 550   | 72    | 64.06 | 134.8 | 900.5 | 46.2  | 25.3  | 4.98 | 66.5 | 28.5 | 8.7   | 8.57 |
| 8    | 14–16              | 19,290| 358   | 59    | 155.07| 175.1 | 981.3 | 101.6 | 14.3  | 5.89 | 59.5 | 32.6 | 10.2  | 10.13|
| 9    | 16–18              | 40,070| 330   | 63    | 75.92 | 141.1 | 1271.1| 33    | 17.6  | 6.89 | 50.5 | 42.6 | 13.5  | 11.85|
| 10   | 18–20              | 26,390| 356   | 61    | 53.68 | 99.3  | 675.1 | 30    | 16.6  | 4.23 | 61.5 | 34.2 | 12.1  | 7.28 |
| 11   | 20–22              | 21,810| 324   | 59    | 45.54 | 69.3  | 718.1 | 24.3  | 14.4  | 6.30 | 51.2 | 42.4 | 14.3  | 10.84|
| 12   | 22–24              | 10,810| 230   | 46    | 61.98 | 58.6  | 804.7 | 44.7  | 10.3  | 9.40 | 56.2 | 34.3 | 17.5  | 16.17|
| 13   | 24–26              | 39,320| 322   | 57    | 45.69 | 109.6 | 911.1 | 32.9  | 13.3  | 8.20 | 59.4 | 32.3 | 16.1  | 14.11|
| 14   | 26–28              | 20,140| 250   | 58    | 54.85 | 84.8  | 783.9 | 21.9  | 15.2  | 9.21 | 63   | 27.7 | 16.2  | 15.84|
| 15   | 28–30              | 20,580| 230   | 61    | 38.69 | 79.8  | 732.4 | 26.9  | 13.8  | 10.04| 52.0 | 37.0 | 17.6  | 17.27|
| 16   | 30–32              | 13,850| 204   | 65    | 74.52 | 164.9 | 1115.9| 73.6  | 12.7  | 19.80| 46.0 | 34.1 | 19.2  | 34.06|
| 17   | 32–34              | 19,420| 164   | 60    | 134.37| 155.7 | 1033.3| 56.5  | 13.4  | 19.94| 40.0 | 40.0 | 19.2  | 34.30|
| 18   | 34–36              | 20,230| 140   | 62    | 49.01 | 86    | 828.9 | 27.1  | 14.6  | 20.04| 32.4 | 47.5 | 20.1  | 34.47|
| 19   | 36–38              | 24,200| 158   | 71    | 70.1  | 78.7  | 905   | 48.1  | 14.9  | 28.90| 26.4 | 44.6 | 28    | 49.71|
| 20   | 38–40              | 21,950| 70    | 66    | 86.45 | 81.2  | 872.6 | 38.2  | 13.9  | 27.60| 21.4 | 50.9 | 27.3  | 47.42|
| 21   | 40–42              | 14,290| 304   | 55    | 199.57| 149.7 | 1445.3| 66.4  | 11.2  | 31.0 | 24.5 | 44.4 | 29    | 53.49|
| 22   | 42–44              | 15,060| 304   | 48    | 29.41 | 42.3  | 837.6 | 21.2  | 9.5   | 34.60| 15.4 | 49.9 | 30.1  | 59.52|
| 23   | 44–46              | 16,430| 248   | 50    | 38.14 | 50.6  | 849.3 | 19.5  | 10.5  | 39.01| 10.2 | 50.7 | 33.1  | 67.10|
| 24   | 46–48              | 10,970| 238   | 48    | 34.24 | 40.3  | 809.6 | 30.5  | 9.5   | 44.01| 10.9 | 45.0 | 35.7  | 75.70|

Elemental concentration in ppm; Sand, Silt, Clay and Calcium carbonate level in percentage.

Fig. 1. Study area map with core sample locations.
mangrove debris. 1 g of the sediment sample was placed in a Teflon bomb, 1 ml of aqua regia (AR grade HNO₃: HCl; 1:3 v/v) was added, followed by 6 ml HF. The sealed bomb was submerged in boiling water bath (2 h and 30 min). After the bomb was removed from the water bath, the contents were added to 5.6 g of boric acid crystals in a 100 ml polypropylene standard flask. The flask was made up to volume (100 ml) with high purity distilled water (HPDW). The accuracy of the present analysis was checked with BCSS-1 analytical standard values and the recoveries of those elements were almost equal to that of the certified values. The laboratory results showed that the recovery efficiency ranges 92 to 97.5% of the studied elements. The limits of detection (LODs) of trace elements are 0.01 µg g⁻¹ for Fe, Zn, Cr, Cu, Co, Ni, Cd, 0.02 µg g⁻¹ for Mn and 0.05 µg g⁻¹ for Pb. Fe and Mn

Table 2
Elemental concentration, textural characteristics of sediment, Calcium carbonate (CaCO₃) and Organic matter (OM) level of core sediments, Kurusadai Island, Gulf of Mannar, Southeast coast of India.

| S.no | Subsample Interval | Fe    | Mn   | Pb   | Zn   | Ni   | Cu   | Sand | Clay | Silt | CaCO₃ | OM    |
|------|--------------------|-------|------|------|------|------|------|------|------|------|-------|-------|
| 1    | 0–2                | 32,980| 1308 | 76   | 62.47| 58.2 | 23.4 | 13.2 | 42.663| 24.55 | 32.787 | 39.1  | 0.5236 |
| 2    | 2–4                | 34,560| 1084 | 53   | 34.12| 56.7 | 18.2 | 8.9  | 42.448| 25.6  | 31.952 | 38.2  | 0.5398 |
| 3    | 4–6                | 26,920| 916  | 55   | 40.41| 52.8 | 16.4 | 8.5  | 41.303| 22    | 36.697 | 37.1  | 0.5003 |
| 4    | 6–8                | 25,640| 856  | 61   | 52.1 | 83   | 20.8 | 11.2 | 39.809| 20.36 | 39.831 | 35.5  | 0.4895 |
| 5    | 8–10               | 35,690| 672  | 59   | 31.65| 76.6 | 21.1 | 11.5 | 37.85 | 18.689| 43.461 | 34.3  | 0.4008 |
| 6    | 10–12              | 36,200| 712  | 59   | 24.22| 87.6 | 23.1 | 11   | 38.98 | 14.321| 46.699 | 35.2  | 0.3987 |
| 7    | 12–14              | 20,140| 766  | 53   | 60.83| 63.7 | 59.2 | 8.5  | 34.565| 13.602| 51.833 | 29.85 | 0.3789 |
| 8    | 14–16              | 25,830| 970  | 53   | 25.29| 57.5 | 14.9 | 8.5  | 32.589| 13.61 | 53.801 | 29.72 | 0.2989 |
| 9    | 16–18              | 29,620| 752  | 57   | 22.32| 79.6 | 13.7 | 10.6 | 36.891| 11.025| 52.084 | 31.2  | 0.2145 |
| 10   | 18–20              | 30,260| 872  | 59   | 25.97| 61.4 | 22.7 | 8.8  | 37.801| 11.123| 51.076 | 31.8  | 0.2168 |
| 11   | 20–22              | 29,820| 1008 | 50   | 26.64| 51.6 | 22.8 | 6.8  | 39.201| 10.025| 50.774 | 33.9  | 0.2012 |
| 12   | 22–24              | 26,890| 936  | 73   | 27.68| 109.1| 26.2 | 14.7 | 42.258| 10.14 | 47.602 | 34.9  | 0.2132 |
| 13   | 24–26              | 24,580| 726  | 96   | 26.61| 167.8| 23.5 | 20.6 | 42.856| 9.898 | 47.246 | 37.8  | 0.2054 |
| 14   | 26–28              | 29,320| 846  | 83   | 58.2 | 191.4| 31.8 | 19   | 43.563| 9.112 | 47.325 | 38.2  | 0.2047 |
| 15   | 28–30              | 30,110| 834  | 95   | 129.93| 293.2| 244.3| 16.8 | 44.598| 8.089 | 47.313 | 39.3  | 0.1987 |
| 16   | 30–32              | 46,010| 1006 | 62   | 26.47| 70.9 | 23   | 9.5  | 44.698| 8.011 | 47.291 | 39.9  | 0.1856 |
| 17   | 32–34              | 30,770| 846  | 112  | 30.89| 231.9| 21.9 | 28.7 | 45.632| 7.654 | 46.714 | 40.1  | 0.1821 |
| 18   | 34–36              | 34,170| 1004 | 99   | 131.32| 201.2| 53.5 | 24.3 | 47.605| 7.125 | 45.27 | 42.3  | 0.1758 |
| 19   | 36–38              | 31,390| 838  | 56   | 33.61| 72.3 | 26.6 | 10.4 | 48.806| 7.023 | 44.171 | 44.5  | 0.1721 |
| 20   | 38–40              | 32,560| 286  | 63   | 32.32| 94.7 | 23   | 13.1 | 49.652| 6.983 | 43.365 | 45.2  | 0.1692 |

Elemental concentration in ppm; Sand, Silt, Clay and Calcium carbonate level in percentage.

Fig. 2. Ternary diagram for sand–silt–clay distribution.
concentrations in the core sediments are probably supplied through the riverine input and natural processes. The maximum concentration of Fe was noticed in few samples, and it may be due to the presence of Fe rich lithic fragments. The lead concentration may be due to coal incinerating power plants, commercial coal handling harbor activities in the southern part of the Gulf of Mannar and the application of leaded petrol around the coral ecosystem [1].

Transparency document. Supplementary material

Transparency data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.dib.2017.09.070.

References

[1] S. Krishnakumar, S. Ramasamy, T. Simon Peter, Prince S. Godson, N. Chandrasekar, N.S. Magesh, Geospatial risk assessment and trace element concentration in reef associated sediments, Northern part of Gulf of Mannar biosphere reserve, Southeast Coast India. Mar. Pollut. Bull. (2017), http://dx.doi.org/10.1016/j.marpolbul.2017.08.042.
[2] D.H. Loring, R.T.T. Rantala, Manual for the geochemical analyses of marine Sediments and suspended particulate matter, Earth Sci. Rev. 32 (1992) 235–283.

[3] H.E. Gaudette, W.R. Flight, L. Toner, D.W. Folger, An inexpensive titration method for the determination of organic carbon in recent sediments, J. Sediment. Petrol. 44 (1974) 249–253.