Data Article

Surficial sediment data along the shoreface and inner continental shelf of western Victoria, Australia

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\textbf{A R T I C L E   I N F O}

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\textbf{A B S T R A C T}

A comprehensive dataset of 138 surficial sediment samples retrieved from the shallow marine waters of six secondary compartments off the western coast of Victoria, Australia, is presented. Samples were collected between October 2018 and November 2020 at water depths ranging from four to 55 m using Shipek and Van Veen grabs. Sampling design targeted unconsolidated areas of the seafloor based on bathymetric and seafloor habitat data. Retrieved sediments were subsampled and subject to grain size analysis using a combination of dry sieving and laser diffraction methods, carbonate and organic matter content determination via Loss-on-Ignition, colour description using a Munsell chart, and roundness analysis using microscopic photography. This dataset, the most comprehensive surficial shallow water sedimentary record of the Otway Shelf, serves as a benchmark to understand sediment dynamics and connectivity along the coast, and can be used in environmental and engineering studies to support a range of management decisions.

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Specifications Table

| Subject | Earth-Surface Processes |
|---------|-------------------------|
| Specific subject area | Sedimentology, Coastal Geomorphology, Marine Geology |
| Type of data | Table |
| | Image |
| | Figure |
| | Map |
| How the data were acquired | A total of 138 surficial sediment samples were collected from the seafloor. Most samples ($n = 118$) were collected with a Shipek grab and only 20 samples were collected with a Van Veen. Sediment sampling was planned taking into consideration the limits of the coastal compartments, depth and a consolidated/unconsolidated substrate GIS layer. |
| Data format | Raw |
| | Analyzed |
| Description of data collection | Sediment samples were collected between October 2018 and November 2020. The shallowest samples (PF11 and PF21) were retrieved from 4 m depth, whereas the deepest sample (PC01) was collected from depths of 55 m. In the laboratory, grain size analysis, Loss-on-ignition (carbonate and organic matter) and microscopic work were conducted. |
| | Southwest Coast of Victoria, Australia. From the border of South Australia (west) to the entrance of Port Phillip Bay (east)- Within state waters |
| Data source location | Mendeley Data |
| | Offshore sediment samples of coastal compartments of western Victoria, Australia |
| | https://data.mendeley.com/datasets/jz7xhmw52b/1 |
| | doi: 10.17632/jz7xhmw52b.1 |

Value of the Data

- Unconsolidated deposits from the shallow waters of the Otway Shelf, Australia, were poorly studied prior to the collection and analysis of this comprehensive and detailed surficial sediment dataset.
- The retrieved data targeted the main unconsolidated deposits within six secondary coastal compartments from the border of South Australia to Port Phillip Bay forming a benchmark for environmental and engineering studies.
- The dataset can be used in coastal management decisions by policy makers, consultants, researchers and stakeholders to better understand sediment dynamics and budgets.
- Different uses include determining settling velocities and entrainment thresholds of particles and predicting the pattern of sediment transport from changes in grain size distribution.
- Dataset can also provide insight into potential source areas for beach nourishment and susceptibility of different deposits to ocean acidification.

1. Data Description

A comprehensive suite of 138 surficial sediment samples was collected within six coastal compartments to characterize the shoreface and inner continental shelf of western Victoria, Australia (Fig. 1).

The mean grain size in sediment samples ranged from $-1.04$ phi (very fine gravel) to $3.58$ phi (very fine sand) (Fig. 2a). Most samples (109 out of 138) are composed of fine sand. Very fine sand samples ($n = 4$) are only observed to the east of Cape Otway, whereas medium sand samples ($n = 14$) are observed to the east of the Portland compartment. PL15 and TQ16 are the only coarse sand samples. Very coarse sands ($n = 8$) are observed in the Port Fairy, Great Ocean Road and Torquay compartments. TQ05, located to the east of Point Roadknight, is the
only very fine gravel sample. A 30 km stretch between the Great Ocean Road and the Torquay compartments is the most diverse part off western Victoria in terms of grain size variability.

Most samples ($n = 100$) have no gravel size grains, 18 samples have less than 1%, ten samples have between 1.1% and 10%, and five samples have between 10.1 and 25% gravel size grains.
Fig. 2. Mean grain size (a); Gravel (b), sand (c) and mud (d) percentages in samples; Predominant angularity of grains (e).

(Fig. 2b). Sample PF24 has 25.1% of gravel content, TQ08 has 47.7%, GR29 has 62.3% and TQ02 has 66.6%. The fine gravel sample TQ05 was almost entirely (96.3%) made of gravel grains.

Sand size content ranged from 3.5% (TQ05) to 99.5% (PC10) (Fig. 2c). Samples TQ02, GR29 and TQ08 have between 33% and 52% of sand grains. The remaining 134 samples have more than 70% of sand size material. 126 of these samples are made of at least 90% of sand grains.
Mud content of at least 0.2% was observed in all samples, with 43 samples having at least 1% of mud size grains (Fig. 2d). All samples with mud content higher than 3% are located to the east of Cape Otway. TQ12 (5.1%) and GR21 (29.7%) have the highest amounts of mud in their respective compartments.

Sediments ranged from angular to well-rounded grains, with most samples (n = 116) having angular to sub-rounded grains (Fig. 2e). More rounded grains were observed in samples GR33, PF25, PF24, TQ08, TQ06, TQ02, PL15, DB05 and DB02.

Sorting, skewness and kurtosis indicate how similar the samples are to a normal probability curve and are indicative of important sedimentary processes occurring. The dispersion around the average value, known as sorting, ranged from poorly sorted to very well sorted samples (Fig. 3a). Most samples (n = 79) are moderately well sorted. 31 samples are well sorted and 17 are moderately sorted. Moderately well sorted, well sorted and moderately sorted samples occur in all compartments. Apart from sample PL04, all other nine poorly sorted samples are located to the east of Cape Otway. TQ05 is the only very well sorted sample. The greatest variability in terms of sorting occurs to the east of Carisbrook Creek.

The skewness or asymmetry is determined by the relative importance of the tails of the distribution. Symmetrical distributions occurred in half of the analysed samples (Fig. 3b). 53 samples were coarse skewed and occurred in all compartments except Torquay. Fine skewed samples (n = 9) occur mostly to the east of Cape Otway, except for PF06 and PC10. Five very fine skewed samples occur between Kennett River and the town of Torquay. Two other very coarse samples occur in the Great Ocean Road (GR20) and Portland (PL04) compartments.

Kurtosis measures the peakedness of the distribution curves. 45 samples have normal curves (mesokurtic) (Fig. 3c). Most samples (n = 79) have peaked distribution curves (leptokurtic). Six samples are very leptokurtic (more peaked) and sample TQ02 is extremely leptokurtic. Five samples (GR18, GR20, GR27, GR30 and TQ05) are platykurtic (flatter than normal) and two (PF24 and TQ08) are very platykurtic.

CaCO3 content in samples ranged from 30.8 to 90.8%. Samples whose inorganic carbonate content was less than 60% was only observed in the Port Campbell, Great Ocean Road and Torquay compartments. TQ06 had the lowest CaCO3 content of all samples, whereas PC10 (31.6%) and GR20 (48.3%) had the lowest CaCO3 content in their respective compartments. 22 samples located between Discovery Bay and The Gellibrand River, in the Port Campbell compartment, had CaCO3 content higher than 85%. Three of these samples (DB10, PC08 and PF06) surpassed 90%. Inorganic carbonate content ranged little (<20%) in the Portland and Port Fairy compartments but more than 60% (31.6–90.8%) in the Port Campbell compartment.

Organic matter content ranged between 1.1% (TQ12) and 6.1% (TQ05) (Fig. 3e). However, only 20 samples had organic matter content greater than 3%. The four samples (GR28, TQ04, TQ02 and TQ05) with the most organic matter content were found along a stretch of approximately 20 km between the Great Ocean Road and Torquay compartments. PF06 were also high (4.2%) in organic matter.

Sediment colour hues based on the Munsell chart are 2.5Y (n = 122), 7.5YR (n = 1) and 10YR (n = 15), highlighting the predominance of yellow hue (Fig. 4). Most samples (n = 68) can be considered light brown given the medium notation for chroma (/3 or /4), while 56 samples are considered light gray based on high value (5/ or 7/) and low chroma (/1 or /2). Light brown samples were found mostly between Port Campbell and Torquay compartments, whereas light gray samples were found all along four compartments to the west of Cape Otway, particularly at Discovery Bay and Portland compartments. Microscopic photographs taken of selected samples showing different sediment characteristics are shown in Fig. 4.
Fig. 3. Sorting (a); Asymmetry (b); Kurtosis (c); CaCO₃ (d) and Organic matter (e) percentages in samples.
Fig. 4. Sediment colour based on Munsell chart. Microscopic photographs of selected samples taken at 5x magnification. White bar on bottom left of images equivalent to 100 μm. Note light variation in some photographs.
Table 1
Acquisition date, equipment and samples collected within each coastal compartment.

| Sample | Compart ment | Acquisition date | Grab type |
|--------|--------------|------------------|-----------|
| DB01-DB15 | Discovery Bay (DB) | 21 Oct 2020 | Shipek |
| PL01-PL07 | Portland (PL) | 21 Oct 2020 | Shipek |
| PL08-PL13 | 22 Oct 2020 | Shipek |
| PL14-PL17 | 11 Sep 2020 | Shipek |
| PF01-PF20 | Port Fairy (PF) | 21 Oct 2018 | Van Veen |
| PF21, PF22, PF24-PF28 | 26 Jul 2019 | Shipek |
| PC01-PC16 | Port Campbell (PC) | 09 Jul 2020 | Shipek |
| PC17-PC31 | 26 Jul 2019 | Shipek |
| GR01-GR18, GR32-GR36 | Great Ocean Road (GR) | 02 Nov 2020 | Shipek |
| GR19-GR31, GR37 | 03 Nov 2020 | Shipek |
| TQ02-TQ12 | Torquay (TQ) | 03 Nov 2020 | Shipek |

2. Experimental Design, Materials and Methods

The sediment sampling design took into consideration the limits of the six coastal compartments and was planned using a 10-m continuous seamless topographic-bathymetric Digital Elevation Model (DEM) [1] and a derived consolidated/unconsolidated substrate GIS layer. A total of 15 samples were collected in the compartment of Discovery Bay (DB), 17 in Portland (PL), 27 in Port Fairy (PF), 31 in Port Campbell (PC), 37 in Great Ocean Road (GR) and 11 in Torquay (TQ) (Table 1). The number and location of samples were representative of the unconsolidated substrate in each compartment.

One sample located near Lorne (TQ01) was not retrieved despite several attempts made. Due to the seasonal closure of a whale protection zone for migratory Right whales, one sample located inside a protected area near Warrnambool (PF23) was not attempted. Samples were collected between October 2018 and November 2020 using mostly a Shipek grab, although the first campaign used a Van Veen to collect samples PF01-PF20. Sampler change to a Shipek grab allowed the recovery of less disturbed samples from the top seven centimeters of the seafloor. Despite the equipment change, retrieved material from both techniques were considered equivalent. The shallowest samples (PF11 and PF21) were retrieved from 4 m depth, whereas the deepest sample (PC01) was collected from depths of 55 m.

Following retrieval, samples were transferred from the grab to plastic bags and kept on ice until arrival in laboratory. In the sediment laboratory, samples were subsampled in three parts. Approximately 15 g of material of each sample was transferred to vials and stored in a −80 °C freezer for posterior eDNA analysis, while approximately 200 g of materia was subsampled, bagged and kept refrigerated for Organic Carbon analysis. The bulk of material (500 g), object of this article, was washed for salt extraction using glass beakers and oven-dried for four days at 60 °C (Fig. 5).

The dried material was then subsampled, and colour description was conducted for using a Munsell soil colour chart. Sample photographs were taken with a Carl Zeiss Microscope GmbH Axiostar Plus Zen 2 Lite microscope using a 5x/0.12 lens. Microscopic images were used to indicate a qualitative degree of roundness and to facilitate comparison between samples.

Approximately 4 g of sediment per sample were used for determining carbonate and organic matter content via loss on ignition [2,3]. For that, crushed samples were placed in ceramic crucibles and exposed for 1 h at 105 °C, 2 h at 550 °C and 2 h at 950 °C in a muffle furnace.

Approximately 500 g of sample was dry sieved down to 0 phi at half phi intervals to determine size fractions. Size of material finer than 0 phi was obtained by laser scanning using a Beckman Coulter, laser diffraction particle size analyser. Grain size statistics have been calcu-
lated using Folk and Ward [4] formulae. Individual sample results were obtained by running the grain size distribution and statistic software GRADISTAT [5].

Ethics Statements

This work did not involve human subjects, animal experiments or data collected from social media platforms.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Data Availability

Shapefile containing all data presented in manuscript (Original data) (Mendeley Data).

CRediT Author Statement

Rafael C. Carvalho: Conceptualization, Methodology, Visualization, Investigation, Software, Formal analysis, Validation, Data curation, Resources, Writing – original draft, Writing – review & editing, Supervision, Project administration; David Kennedy: Project administration, Funding acquisition; Daniel Ierodiaconou: Data curation, Supervision, Project administration, Funding acquisition, Writing – review & editing.
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