

Supplementary Material

Study area

Clift Sound lies south of Shetland, the islands of Trondra and East Burra to the west. It has steep-sides and a relatively unrestricted geomorphology (Fig. 1a). Two main types of soil are present in the catchment of Clift Sound: humus-iron podzols cover the islands of East Burra and Trondra, while peaty soils dominate the eastern coast of Clift Sound. Winds are generally from the southwest and, due to the geometry of the sound and the surrounding highlands, can be channelled and result in intensified currents. Tidal energy can also be channelled into more vigorous currents (Cefas 2007a).

Sand Sound is located in the southwest of Shetland (Fig. 1a) and comprises three areas: the head of the voe, the inner basin and the outer basin. The head of the voe, a sheltered area, receives freshwater from a significant number of rivers draining the surrounding land. Three main types of soil characterise this area: peaty gleis, peaty podzols and peaty rankers. Here, the voe is very shallow and drying can occur in its eastern and western periphery (Cefas 2007b, 2008b). In contrast, the rest of the voe is much deeper. The inner basin gently slopes away reaching more than 20m at its maximum depth; drying can still occur where this basin meets the head of the voe (Cefas 2007b). The outer basin has steep sides, is 42 m deep at its deepest point and completely open to sea. A shallow sill divides the inner from the outer basins (Cefas 2007b)

Busta Voe, Olna Firth and Aith Voe are part of a major inlet on the southern coastline of St Magnus Bay on the west coast of Shetland (Fig.1a). Olna Firth represents the eastern branch of the inlet and is roughly oriented east – west (Fig. 1a). A large area of this voe exceed 30 m water depth; the northern coastline gradually slope into the voe, whereas the south side shows a steeper gradient. Olna Firth is classified as micro-tidal and due to the generally low level of energy in this system, stratification may occur, especially during summer time (Cefas 2013).

Aith Voe is the southern component of the inlet, with a north – south orientation (Fig. 1a). Due to the hilly landscape (up to 100 m) surrounding the voe, Aith Voe is exposed to winds from the north, which can significantly alter local circulation and prevent stratification of the water column. Two types

of soil surround Aith Voe: peaty and organic soils; few streams drain these soils, with the largest of them discharging on the east coast of Aith Voe (Cefas 2010).

Busta Voe lies in the northern part of the inlet and is oriented north – south, sheltered and with a maximum water depth of 39 m (Fig. 1a). Three main types of soil surround this area: peaty gleis, peaty podzols and peaty rankers; two rivers drain a relatively small catchment area into Busta Voe. Tidal flow is weak in the voe and wind generated currents are predominant; stratification of the water column especially during warm periods can occur (Cefas 2008a).

Vaila Sound lies on the western coast of Shetland, with the island of Vaila to the southwest and the isle of Linga in the middle (Fig. 1a). Three types of soil dominate the catchment of this voe: peaty gleis, peaty podzols and peaty rankers. Most streams discharge in the northern part of the sound; hence, locations in this area might become more affected by terrigenous inputs. Additionally, Linga offers protection from wind and currents, which could facilitate localised accumulation of terrigenous material. Shelter from strong winds is also provided by the island of Vaila to the south. Here the tidal range is small and the associated energy weak; however, Vaila Sound has a relatively unrestricted geomorphology and it is connected to the Atlantic Ocean west and east of the island of Vaila (Cefas 2009).

Methods

Loss on ignition

About 1g of dried sediment was precisely weighted into crucibles of known weight for each surface sample (M_0). These were ashed in a muffle furnace at 250° C for 4 hours, cooled and weighted (M_{250}). Samples were then returned to the furnace at 550° C for 4 hours, cooled and re-weighted (M_{550}). TOM, LOM and ROM were calculated as follow:

$$\text{LOM} = [(M_0 - M_{250}) / M_S] * 100$$

$$\text{ROM} = [(M_{250} - M_{550}) / M_S] * 100$$

$$\text{TOM} = \text{LOM} + \text{ROM}$$

Where M_s is the sample weight minus the crucible weight.

Supplementary Table 1. Benthic foraminifera relative abundance data

Sample ID	Ammonia spp.	Ammoscalaria runiano	Bolivina skagarakensis	Bolivina spathulata	Bolivina pseudoplicata	Bolivina pseudopunctata	Bolivina variabilis	Buccella frigida	Buccella tenerrima
MD15-01A	0.2	0.0	0.0	0.0	0.5	1.1	2.9	0.2	0.2
MD15-01B	0.2	0.0	0.0	0.0	0.8	1.3	2.7	0.5	0.0
MD15-02	0.0	0.0	0.0	0.3	1.2	3.1	1.9	0.2	0.0
MD15-03	0.2	0.0	0.3	0.8	1.2	2.5	2.1	1.5	0.5
MD15-04	0.3	0.0	0.2	0.9	0.9	2.3	1.1	2.9	0.6
MD15-05A	0.0	0.0	0.1	1.5	0.0	1.2	1.3	0.1	0.4
MD15-05B	0.0	0.0	0.6	2.4	0.5	1.2	1.2	0.0	0.2
MD15-06	4.8	0.0	0.0	0.0	1.3	0.5	0.3	0.2	0.5
MD15-07	6.5	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0
MD15-08	3.0	0.0	0.2	0.0	0.0	1.3	0.6	0.0	0.0
MD15-09	5.4	0.0	0.0	0.0	0.0	0.3	0.2	0.3	0.0
MD15-10	0.9	0.0	0.5	0.3	0.9	1.4	0.6	0.3	0.0
MD15-11	0.0	0.0	0.5	0.0	0.0	1.4	2.0	0.0	0.2
MD15-12	8.5	0.0	0.6	0.1	0.3	2.0	1.7	0.0	0.1
MD15-13	3.0	0.0	1.6	0.0	0.0	1.9	1.1	1.0	0.0
MD15-14	12.6	0.9	4.1	0.0	0.0	1.5	3.7	0.0	0.3
MD15-15	1.0	0.0	0.8	0.0	0.3	2.6	3.1	0.0	0.5
MD15-16	5.7	0.0	2.6	0.0	0.2	2.9	2.0	0.0	0.0
MD15-17	2.2	0.0	1.8	0.0	0.7	1.2	1.4	0.0	0.1
MD15-18	6.1	0.0	0.0	0.0	0.0	4.3	1.1	2.5	0.1
MD15-19	10.2	0.0	0.1	1.6	0.1	1.2	1.2	4.1	0.3
MD15-20	0.0	0.0	0.1	2.0	0.0	0.8	0.1	0.3	0.0
MD15-21	0.3	0.0	0.1	2.0	0.3	0.8	0.8	0.1	1.0

Bulimina elongata	Bulimina gibba	Bulimina marginata	Buliminella elegantissima	Cassidulina laevigata	Cassidulina obtusa	Cibicoides spp.	Cornuspira sp.	Eggerelloides scaber	Elphidium aculeatum
0.3	0.0	0.5	2.1	0.0	1.1	14.5	0.0	22.0	0.2
0.0	0.0	0.6	2.1	0.2	0.9	15.0	0.0	19.9	0.2
0.0	0.0	0.7	0.3	0.0	1.2	47.6	0.2	10.6	0.0
0.2	0.0	1.2	0.7	0.5	2.3	53.7	0.0	3.3	0.0
0.0	0.0	0.9	0.3	0.3	3.4	48.9	0.0	5.2	0.0
0.1	0.0	0.3	0.0	1.3	3.7	57.6	0.0	2.1	0.1
0.0	0.0	0.6	0.0	1.1	5.3	56.7	0.0	2.1	0.2
1.2	0.0	0.5	4.6	0.0	0.2	2.0	0.0	25.5	0.3
0.0	0.0	0.8	4.8	0.0	0.3	5.5	0.0	27.7	0.8
1.6	0.0	1.7	11.4	0.0	0.3	2.0	0.0	29.7	0.0
0.0	0.2	0.9	8.8	0.0	0.5	1.9	0.2	19.7	0.6
0.0	0.0	3.8	1.9	0.0	1.6	8.3	0.0	43.0	0.0
0.5	0.0	14.8	0.8	0.0	1.4	10.9	0.0	31.9	0.0
0.7	0.0	8.6	0.7	0.1	0.6	13.7	0.0	22.9	0.1
0.9	0.0	5.6	12.6	0.3	1.6	14.2	0.0	11.7	0.3
1.5	0.0	4.1	4.6	0.4	1.9	26.1	0.0	10.0	0.0
0.0	0.0	2.8	2.0	0.0	1.8	30.1	0.0	12.9	0.0
0.6	0.0	8.5	0.9	0.0	0.9	7.6	0.0	26.4	0.0
0.0	0.0	1.2	0.1	0.0	0.7	70.1	0.0	2.8	0.0
0.0	0.0	0.9	11.5	0.0	0.5	24.4	0.0	9.5	0.3
0.0	0.3	2.1	1.8	0.3	4.2	29.6	0.0	8.8	0.0
0.0	0.0	0.4	0.1	0.0	2.4	68.7	0.0	0.4	0.0
0.1	0.0	1.4	0.3	0.4	3.9	56.8	0.1	1.9	0.0

Elphidium albumbelicatum	Elphidium crispum	Elphidium gerthi	Elphidium incertum	Elphidium margaritaceum	Elphidium excavatum	Elphidium sp.	Elphidium williamsoni	Epistominella vitrea	Fissurina spp.
0.0	0.0	10.7	0.2	20.1	7.8	0.0	0.3	0.5	0.6
0.2	0.0	10.7	1.3	24.3	2.1	0.6	0.2	0.0	0.2
0.3	0.2	5.4	0.0	3.1	1.9	0.0	0.2	0.3	0.2
0.0	0.0	10.5	0.2	0.8	1.2	0.2	0.0	0.5	0.3
0.0	0.2	13.9	0.3	0.2	0.0	0.9	0.2	0.0	1.1
0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.1	0.0	0.4
0.0	0.6	0.2	0.0	0.0	0.5	0.0	0.5	0.0	0.8
3.0	0.2	15.6	1.5	6.1	15.3	0.0	1.8	0.0	0.2
1.1	0.3	11.7	1.4	7.6	21.5	0.0	0.7	0.0	0.0
0.9	0.2	7.5	0.3	1.4	22.4	1.1	0.5	1.3	0.2
2.1	0.0	9.8	0.2	10.1	25.6	1.1	2.4	0.9	0.2
0.9	0.0	4.7	0.2	1.3	5.2	0.0	0.5	0.3	0.6
0.2	0.0	4.4	0.2	1.8	0.8	0.0	0.0	0.3	0.0
0.0	0.0	2.2	0.0	0.9	2.4	0.4	0.0	0.9	0.6
0.0	0.0	9.3	0.0	4.0	10.0	0.4	2.3	0.3	0.1
0.0	0.1	8.2	0.1	0.9	4.3	0.1	0.4	0.6	0.0
0.0	0.2	7.0	1.5	5.1	5.6	0.3	2.0	0.7	0.8
0.3	0.0	5.0	0.5	1.2	5.1	0.0	0.3	1.2	0.5
0.0	1.7	1.4	0.0	0.8	1.5	0.1	0.0	0.6	1.1
0.0	0.3	7.6	0.5	9.0	9.2	0.0	0.3	0.0	0.3
0.1	0.1	8.3	0.7	3.4	9.2	0.0	0.0	0.3	0.1
0.0	0.4	1.2	0.1	0.9	1.2	0.0	0.0	0.1	0.0
0.1	2.4	1.9	0.1	1.0	2.9	0.0	0.1	0.1	0.3

Connemarella rudis	Globobulimina affinis	Haplophragmoides sp.	Haynesina germanica	Hyalina balthica	Lagena clavata	Lagena semistriata	Lagena setigera	Lamarckina heliotidea	Miliolinella subrotunda
0.0	0.0	2.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.9	1.7	0.0	0.2	0.0	0.0	0.0	0.2
0.0	0.0	1.2	0.2	0.0	0.2	0.2	0.0	0.0	0.3
0.0	0.3	2.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.9	0.5	0.0	0.0	0.2	0.0	0.0	0.0
0.0	0.0	1.6	0.1	0.0	0.0	0.0	0.0	0.0	2.2
0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	1.4
0.0	0.0	0.3	5.8	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.3	2.1	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.2	1.7	0.0	0.3	0.0	0.0	0.0	0.0
0.0	0.0	0.0	2.1	0.0	0.0	0.2	0.0	0.0	0.0
0.0	0.0	0.6	0.0	0.0	0.2	0.0	0.0	0.0	0.0
0.0	0.2	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0
0.0	1.2	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
0.0	0.7	0.9	2.0	0.0	0.0	0.0	0.1	0.0	0.0
0.0	0.3	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0
0.0	0.0	2.9	0.8	0.0	0.0	0.0	0.0	0.0	0.2
0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.2	0.0	0.0
0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.4
0.0	0.0	0.1	1.3	0.0	0.0	0.1	0.0	0.0	0.0
0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.1	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
0.0	0.0	0.1	0.0	0.0	0.1	0.4	0.0	0.0	0.8

Nonion depressulum	Nonion porporatum	Nonionella turgida	Oolina hexagona	Oolina mellow	Oolina sp.	Oolina squamosa	Oolina williamsoni	Discanomalina sp.	Patellina corrugata	Planorbulina distoma
0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.3	0.0	0.5	0.0
0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.5	0.0
0.0	0.5	0.0	0.0	0.2	0.0	0.0	0.3	0.0	0.9	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
0.0	0.6	0.2	0.0	0.0	0.0	0.0	0.3	0.0	0.5	0.0
0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.3
0.0	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.2	0.8	0.3
0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
0.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
0.0	0.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.4	0.0
0.0	1.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
0.0	0.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	0.9	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.1	0.0
0.0	0.3	0.3	0.1	0.0	0.0	0.0	0.4	0.0	0.1	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1

Quinqueloculina bicornis	Quinqueloculina seminulum	Quinqueloculina sp.	Reophax fusiformis	Reophax scotii	Rosalina anomala	Rosalina sp.	Spirillina vivipara	Spiroloculina rotunda
0.3	0.2	0.0		0.3	0.0	3.8	0.0	0.0
0.0	0.2	0.0		0.2	0.0	3.2	0.0	0.0
0.0	1.6	0.0		0.0	0.2	6.6	0.0	0.0
0.0	0.0	0.0		0.0	0.0	5.4	0.0	0.0
0.2	1.2	0.0		0.0	0.3	4.7	0.0	0.0
0.1	1.3	0.0		0.0	3.6	9.7	0.0	0.7
0.3	2.4	0.0		0.0	2.7	10.4	0.0	0.2
0.0	0.2	0.2		3.1	0.0	0.0	0.0	0.0
0.0	0.0	0.3		2.8	0.0	0.7	0.0	0.0
0.0	0.0	0.0		1.4	0.0	0.2	0.0	0.0
0.0	0.0	0.0		0.2	0.0	0.2	0.0	0.0
0.0	0.2	1.4		5.0	0.0	1.4	0.0	0.0
0.0	0.0	0.0		0.0	0.0	0.5	0.0	0.0
0.0	0.3	0.0		0.3	0.0	0.3	0.0	0.0
0.0	0.0	0.1	0.3	1.9	0.0	0.3	0.0	0.0
0.0	0.0	0.0	0.6	0.3	0.1	1.8	0.0	0.0
			0.0					
0.0	0.0	0.0		0.2	0.0	0.8	0.0	0.0
0.0	0.0	0.0	0.5	0.3	0.0	0.2	0.0	0.0
0.1	1.1	0.1		0.0	0.0	1.1	0.0	0.0
			0.0					
0.0	0.0	0.0		1.1	0.0	2.3	0.0	0.0
0.0	0.3	0.0		0.0	0.0	4.5	0.0	0.0
0.0	1.2	0.3		0.3	1.4	14.7	0.0	0.1
0.0	0.8	0.3		0.0	2.4	11.3	0.1	0.1

Spiroplectinella wrightii	Stainforthia fusiformis	Textularia earlandi	Trifarina angulosa	Trochamina sp.	Indetermined	N of species
0.0	3.0	0.5	0.0	1.1	0.0	32
0.0	4.4	0.5	0.0	1.4	1.6	34
0.2	3.8	0.2	0.0	2.3	1.9	36
1.0	4.6	0.0	0.0	1.0	0.0	31
1.4	2.9	0.0	0.0	1.5	0.0	35
3.4	0.7	0.0	0.1	1.8	1.9	33
3.9	1.5	0.0	0.0	0.6	0.0	34
0.0	1.3	1.2	0.0	1.8	0.7	31
0.0	0.0	0.0	0.0	1.5	0.6	25
0.0	6.3	0.0	0.0	1.1	0.2	30
0.0	1.6	0.0	0.0	0.8	2.2	31
0.0	11.3	0.3	0.0	1.4	0.0	32
0.0	23.1	1.1	0.0	0.9	1.2	27
0.4	26.0	1.0	0.0	1.0	0.0	35
0.1	7.3	0.7	0.0	0.9	0.0	35
0.6	8.2	0.3	0.0	0.3	0.0	34
0.7	8.2	0.3	0.2	1.1	2.3	33
0.3	23.1	0.6	0.0	0.2	0.3	33
1.0	4.8	0.0	0.0	0.7	0.0	28
0.0	4.0	0.3	0.0	0.6	0.1	31
0.0	4.3	0.5	0.3	0.4	0.0	37
1.1	0.5	0.0	0.1	0.1	0.0	29
1.9	1.4	0.0	0.1	0.1	0.1	43