Metadata and method-Documentation of sediment analysis from
Senckenberg Institute,
Department Marine Science

PROJECT:

Senckenberg Institute, Department of Marine Science, Division of Marine Sedimentology

Institute-internal Project, called *SPIEKEROOG*-Programme

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CAMPAIGN

First sedimentological investigation of Spiekeroog Island from 1985 to 1991

SAMPLING

1. General strategy: Sampling along a grid.
   Latitude interval: 0°0'.150N, starting at 53°42.00N, ending at 53°53.00N
   Longitude interval: 0°0'.250E, starting at 7°37.250, ending at 7°52.000E

2. Ship: RV "*SENCKENBERG*" and work boat "*SAM I*"

3. Technical devices:

Sampling

Method	Specification	Sampling locations	Sampling strategy
van Veen Grab 0,2m²	upper 5 cm of undisturbed sediment surface	Nearshore, tidal inlets, tidal channels with water depth >7m	spot surface sampling
van Veen Grab 0,1m²	upper 5 cm of undisturbed sediment surface	Harle- tidal inlet, tidal channels (Swinn-, Mittelbalje, Wattfahrwasser-Ost, Muschelbalje, water depth 5.00-7.00m	spot surface sampling
van Veen Grab 0,03m²	mixed-sample of the upper 10cm sediment surface	Nearshore, Flood channels, tide-ways, shallow water 0.5m – 5.00m	spot surface sampling
150ml plastic beaker	upper 5 cm of surface	Tidal flats	spot surface sampling

Sample positioning:

Device	Accuracy
Decca-Radio, Type Shipmate RS4000	used from 1985 to 1990, Precision: +/- 50m
Decca-Radio, Type Phillips APN3	used from 1985 to 1990 Precision: +/- 50m
Satellite navigation GPS Magellan 5000-D	1990-1991 Precision: +/- 15m

ANALYTIC SYSTEMS

1. Settling tube MacroGranometer MC86™ by Granometry™

Settings / Features / Characteristics	Specification
Active settling tube length	180cm
Tube diameter	20cm
Shock prevention	2 pneumatic absorbers
Analytic software version	V6.2
Operation temperature	depend on room temperature 2 sensors
Operation Fluid	de-mineralized water
Analysed sample volume	1.3g (fine sand) – 2.0g (coarse sand)
Settling velocity range PSI - range (psi = $-\log_2$ v [m/sec])	-5.00 – 3.00psi 2^5 cm/sec = 32.000cm/sec – 2^{-3} cm/sec = 0.125cm/sec
equivalent grain size range PHI – range (phi = $-\log_2$ d [mm]	-2.00 – 5.00phi 2^2mm = 4.000mm - 2^{-5}mm = 0.016mm
Shape factor (SF)	1.180
Specific density (RS)	2.650 [g/cm^3]
Gravity (local value for Wilhelmshaven)	981.375
Standard Deviation = Sorting (St.Dev, Sort)	Inman 1952
Skewness (Skew)	Inman 1952
Kurtosis (Kurt)	Inman 1952
Arithmetric Mean (mean)	
Liquid Parameter PSI for “Local Analysis”	seawater
Salinity Parameter PSI for “Local Analysis”	3%
Temperature Parameter for “Local Analysis	5°C, 20°C, 24°C
Interval Step for “Local Analysis”	0.1

General remark: Within the tables the percentage values of the 0.25 step interval fractions are directly imported from the generated Granometry™ files. Therefore negative values represent basic oscillation of the balance.

2. SediGraph 5100 Particle Size Analysis System, Micromeritics Instrument Cooperation™, Norcross, Georgia USA:
The system consists of three components: SediGraph 5100™, MasterTech 51™, and the Control Module.
The automatic sampling device MasterTech™ 51 consists of a revolver-system which enables users an unattended analysis of 18 samples. The control module is a PC, with a real-time clock and a printer.

Specification of SediGraph 5100 unit:

Settings Features Characteristics	Specification
Calibration and Analysis	internal fixed five-position X-ray Source/Detector
Accountability for statistics	All particles within the sample cell, including those which are outside the selected range (pre-selected analysis points)
Maximum of pre-selected analysis points, versus intervals	29
Particle-size-range	300 –0.1 micrometer [µm]
Sample mass	3.5 g
Operation temperature	standard 37,2°C
Software version	V3.07
Sample density	2.65[g/ccm] (Quartz standard)
Operation fluid	water
Fluid density	0.9933[g/ccm]
Fluid viscosity	0.6913[cp]
Baseline / Full scale	130 / 89 kilocounts/sec
Starting diameter	100.00[µm]
Ending diameter	0.50[µm]
Reynolds number	1.87

Literature:

Brezina, J. 1978: MacroGranometer Standard 1978, Operation Program Manual: GranoMetry, D-6903 Neckargemünd-3, W. Germany, 3rd edition, 10 November 1978 (unpublished manual), 22 pages

Brezina, J., 1979: Particle size and settling rate distributions of sand-sized materials: 2nd European Symposium on Particle Characterisation (PARTEC), Nürnberg, West Germany, reprinted (+1 page of comments and corrections) by the author on 26 May 2006; 44 pages.

SediGraph 5100 Particle Size Analysis System, 1993, Operation Manual, Micromeritics Instrument Cooperation™, Norcross, Georgia USA; 58 pages

Fig. 7.2: Grade scale in phi units (grain size) and psi (settling velocity)

D: 2.65 g/cm³ T: 24°C SF: 1.18

	PHI	mm	PSI	cm/sec
very fine gravel	-2.00	4.000	-5.40	42.22
	-1.75	3.364	-5.24	37.79
	-1.50	2.828	-5.09	34.06
	-1.25	2.378	-4.93	30.48
very coarse sand	-1.00	2.000	-4.77	27.28
	-0.75	1.682	-4.59	24.08
	-0.50	1.414	-4.41	21.26
	-0.25	1.189	-4.22	18.64
coarse sand	0.00	1.000	-4.02	16.22
	0.25	0.841	-3.81	14.03
	0.50	0.707	-3.59	12.04
	0.75	0.595	-3.35	10.20
medium sand	1.00	0.500	-3.09	8.51
	1.25	0.420	-2.82	7.06
	1.50	0.354	-2.52	5.73
	1.75	0.297	-2.20	4.59
fine sand	2.00	0.250	-1.87	3.66
	2.25	0.210	-1.51	2.85
	2.50	0.177	-1.13	2.19
	2.75	0.149	-0.73	1.66
very fine sand	3.00	0.125	-0.31	1.24
	3.25	0.105	0.12	0.92
	3.50	0.088	0.57	0.67
	3.75	0.074	1.03	0.49
very coarse silt	4.00	0.063	1.49	0.36
	4.25	0.053	1.97	0.26
	4.50	0.044	2.44	0.18
	4.75	0.037	2.93	0.13
	5.00	0.032	3.40	0.09

PSI	cm/sec	PHI	mm	
-5.25	38.05	-1.76	3.387	
-5.00	32.00	-1.36	2.567	
-4.75	26.91	-0.98	1.973	very coarse sand
-4.50	22.63	-0.62	1.537	
-4.25	19.03	-0.29	1.223	
-4.00	16.00	0.02	0.986	
-3.75	13.45	0.32	0.801	coarse sand
-3.50	11.31	0.60	0.660	
-3.25	9.51	0.85	0.555	
-3.00	8.00	1.08	0.473	
-2.75	6.73	1.31	0.403	medium sand
-2.50	5.66	1.52	0.349	
-2.25	4.76	1.72	0.304	
-2.00	4.00	1.90	0.268	
-1.75	3.36	2.08	0.237	
-1.50	2.83	2.25	0.210	fine sand
-1.25	2.38	2.42	0.187	
-1.00	2.00	2.58	0.167	
-0.75	1.68	2.73	0.151	
-0.50	1.41	2.89	0.135	
-0.25	1.19	3.04	0.122	
0.00	1.00	3.18	0.110	very fine sand
0.25	0.84	3.32	0.100	
0.50	0.71	3.46	0.091	
0.75	0.59	3.60	0.083	
1.00	0.50	3.74	0.075	
1.25	0.42	3.87	0.068	
1.50	0.35	4.01	0.062	
1.75	0.30	4.14	0.057	
2.00	0.25	4.27	0.052	
2.25	0.21	4.40	0.047	
2.50	0.18	4.53	0.043	very coarse silt
2.75	0.15	4.66	0.040	
3.00	0.13	4.79	0.036	
3.25	0.11	4.92	0.033	