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Title
Recent Sediments of the Central California Continental Shelf, Pigeon Point to Sand Hills Bluff: Part A -- Introduction and Grain Size Analysis

Permalink
https://escholarship.org/uc/item/19s21804

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Publication Date
1970-10-01
RECENT SEDIMENTS OF
THE CENTRAL CALIFORNIA
CONTINENTAL SHELF
PIGEON POINT TO SAND HILLS BLUFFS

PART A. INTRODUCTION AND
GRAIN SIZE DATA

by

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T. YANCEY
and
P. WILDE

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COLLEGE OF ENGINEERING

UNIVERSITY OF CALIFORNIA
BERKELEY
OCTOBER 1970
University of California
Hydraulic Engineering Laboratory

Technical Report
HEL-2-28

This work was supported by Contract 72-67-C-0015
with the Coastal Engineering Research Center,
Corps of Engineers, U. S. Army

RECENT SEDIMENTS OF THE CENTRAL CALIFORNIA
CONTINENTAL SHELF
PIGEON POINT TO SAND HILL BLUFFS

PART A - INTRODUCTION AND GRAIN SIZE ANALYSIS

by

J. Lee, T. Yancey, and P. Wilde

Berkeley, California
October 1970
Introduction

The following work is part of a continuing study of the sediments and sedimentary processes of the continental shelf of central California done in cooperation between the University of California, Berkeley, and the Coastal Engineering Research Center, U. S. Army Corps of Engineers. Sediment analyses of the samples were done at the University of California, Berkeley, utilizing the facilities of the Departments of Civil Engineering and Geology and the Institute of Marine Resources. The results of this study will be presented in three separate reports:

Part A  Introduction and Grain Size Data (this volume)
Part B  Mineralogical Data
Part C  Interpretation and Summary of Results

The first two reports, Parts A and B, will be presented with little or no interpretation. In Part C the authors' interpretation of the data plus background information and previous work in the study area will be given.

The area covered by this report extends from Pigeon Point in the north to Sand Hill Point in the south. With the completion of this report a complete section of the continental shelf of California from Russian River to Monterey Bay will have been studied. The methods of sediment analysis employed in the overall study are grain size analysis followed by heavy mineral analysis and interpretation.

Sample Collection

Samples studied in this report include 39 marine samples, and 9 intertidal beach samples taken specifically for this project. Marine
bottom samples were obtained with an orange peel grab sampler from the converted fishing boat San Michele, September 1969. Participants in the marine sampling program were Ralf Carter, Eugene Silva, Tom Yancey, Jamison Bates, and Pat Wilde. Marine samples were obtained from the shoreline to 300 feet below sea level. The sample density is approximately uniform within the study area (see Fig. 1). Intertidal beach samples were obtained in April 1970 by James Lee and Tom Yancey. The beach samples were obtained using a pipe coring device. The coring device was inserted into the beach at approximately mid to low tide level. In this manner a core of the upper six to ten inches of the beach sediment was obtained.

Figure 1 shows the sampling stations (numbers refer to Hydraulic Engineering Laboratory Sediment Collection numbers, U. C. Berkeley) plotted on U. S. Coast and Geodetic Survey Chart 5402. Location of each sample was obtained by Decca radar bearings on shore landmarks. Station depths were obtained by echo sounding with a Raytheon depth finder.

The orange peel bottom sampler took approximately 15 centimeters of surface material. About one liter by volume of sample was saved from each station. This portion of the sample was saved from each station. This portion of the sample was placed in a polyethylene bag and stored in a moist condition in a cylindrical cardboard container until analysis.

Grain Size Analysis

The samples were analyzed by Tom Yancey and James Lee at half phi intervals (Krumbein and Pettijohn, 1938, p. 84) through the entire
FIG 1 SAMPLE LOCATIONS

SANFVS

FRANC&CCA

PIGEON POINT

PT. ANO NUEVO

SCALE

0  2  4  6  8  MILES

CONTOUR INTERVAL
10 FATHOMS

ADAPTED FROM
U.S.C.&G.S. CHART 5402
range of the sediment size spread. The sediments contain a wide spread of grain sizes, so for the finer grained samples sieving was supplemented by pipette analysis (Folk, 1965, pp. 37-40) for the silt and clay fraction of the sample. The samples were wet sieved through a 4ϕ (.0625 mm) screen with running sea water. The coarser than 4ϕ sediments were then dried and sieved in the standard manner. Particles in the silt and clay size range were washed into a reservoir of sea water, and recovered and stored wet in sea water. This procedure enables one to separate silts and clays from coarser particles in a non-destructive manner, i.e., the original composition and particle size of the finer sediments is not changed by treatment with distilled water and drying. The weight of the sample was determined using the wet weighing method of Wilde and others (1970).

The pipette analysis was made at half phi intervals, and carried to a lower limit of 8½ϕ (0.0027 mm). Only a small number of the samples were carried to 8½ϕ; these samples had 80% or greater in the silt and clay size fraction. The remaining samples were carried to a lower limit of 7ϕ (0.0078 mm). 7ϕ is a convenient lower limit to use in pipette analysis, and in most cases the finer than 7ϕ fraction represented less than 5% of the sample. Data from this method was proportionately recalculated to fit the sieving data and the size frequency curve and cumulative curve were assembled from these two methods. Each size fraction of the sieving and pipette analysis were weighted on an analytical balance to 0.001 gram and a weight percent value was calculated for each fraction.

The samples were sized through the following sieves:
<table>
<thead>
<tr>
<th>U. S. Standard Mesh Number</th>
<th>Nominal Opening</th>
<th>Phi Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3.962 mm</td>
<td>-2.0</td>
</tr>
<tr>
<td>7</td>
<td>2.83 mm</td>
<td>-1.5</td>
</tr>
<tr>
<td>10</td>
<td>1.981 mm</td>
<td>-1.0</td>
</tr>
<tr>
<td>14</td>
<td>1.397 mm</td>
<td>-0.5</td>
</tr>
<tr>
<td>18</td>
<td>0.991 mm</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>0.701 mm</td>
<td>+0.5</td>
</tr>
<tr>
<td>25</td>
<td>0.495 mm</td>
<td>+1.0</td>
</tr>
<tr>
<td>45</td>
<td>0.351 mm</td>
<td>+1.5</td>
</tr>
<tr>
<td>60</td>
<td>0.246 mm</td>
<td>+2.0</td>
</tr>
<tr>
<td>80</td>
<td>0.175 mm</td>
<td>+2.5</td>
</tr>
<tr>
<td>120</td>
<td>0.124 mm</td>
<td>+3.0</td>
</tr>
<tr>
<td>170</td>
<td>0.088 mm</td>
<td>+3.5</td>
</tr>
<tr>
<td>230</td>
<td>0.061 mm</td>
<td>+4.0</td>
</tr>
</tbody>
</table>

**Data Format**

The grain size information for each sample is presented in the following pages graphically as (1) a histogram where the width of each bar represents the size range considered and the height of the bar represents the weight percent of that size range; and (2) a cumulative frequency curve, which is a smooth curve drawn between points determined by adding weight percent values in successively smaller grain size classes. Points connected by dashed lines are symmetrically extrapolated values and do not represent measured values.

Modes, or the order of frequency, are determined visually from the histogram, with the first mode being the size class with the
largest weight percent value.

Quartile and percentile values or grain size values at a given weight percent are determined visually from the cumulative curves and are used for calculating statistical measures below. The percentile and quartile subscripts given here indicate the percentage of the distribution coarser than the corresponding grain size value. For example, \( P_{10} \) refers to the grain size at which 10% of the distribution is coarser. This procedure does not conform to standard statistical usage but is less ambiguous for grain size work where by convention the cumulative is plotted in order of decreasing grain size, which is the reverse of statistical practice.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Grain Size at</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P_{10} )</td>
<td>10(^{th}) percentile</td>
</tr>
<tr>
<td>( Q_{25} )</td>
<td>25(^{th}) percentile (3(^{rd}) quartile)</td>
</tr>
<tr>
<td>( Q_{50} )</td>
<td>50(^{th}) percentile (2(^{nd}) quartile)</td>
</tr>
<tr>
<td>( Q_{75} )</td>
<td>75(^{th}) percentile (1(^{st}) quartile)</td>
</tr>
<tr>
<td>( P_{90} )</td>
<td>90(^{th}) percentile</td>
</tr>
<tr>
<td><strong>MEDIAN</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Graphically Determined**
Calculated

\[ S_0 = \sqrt{Q_{25}/Q_{75}} \]

**SORTING COEFFICIENT:**  
(Trask, 1932)  
Degree of Scatter

\[ S_k = \frac{Q_{25} - Q_{75}}{(Q_{50})^2} \]

**QUARTILE SKEWNESS:**  
(Trask, 1932)  
Symmetry of Distribution

\[ K = \frac{Q_{25} - Q_{75}}{2(P_{10} - P_{90})} \]

**KURTOSIS:**  
(Krumbein and Pettijohn, 1938, p. 238)  
Comparison of Central Portion of Curve to Spread of Whole Curve

The above calculated statistical parameters plus median grain size are plotted uncontoured on the basemap as follows - Fig. 2: Median Grain Size; Fig. 3: Sorting Coefficient; Fig. 4: Skewness; Fig. 5: Kurtosis.

For possible further analysis and for those who prefer phi units as the grain size measure, the following statistical parameters have been calculated: Inclusive Graphic Standard Deviation (sorting coefficient), (Folk, 1965, p. 46), Inclusive Graphic Skewness (Folk, 1965, p. 47), and Graphic Kurtosis (Folk, 1965, p. 48). The above calculated statistical parameters plus phi median grain size are plotted uncontoured on the basemap as follows - Fig. 6: Phi Median Grain Size; Fig. 7: Inclusive Graphic Standard Deviation; Fig. 8: Inclusive Graphic Skewness; and Fig. 9: Graphic Kurtosis.
FIG 3 SORTING COEFFICIENT

cales

CONTOUR INTERVAL
10 FATHOMS

ADAPTED FROM
U.S.C.&G.S. CHART 5402

SAN LORENZO RIVER

SANTA CRUZ

SAN FRANCISCO

MONTEREY BAY

PESCADERO CREEK

PT. ANO NUEVO

PIGEON POINT
FIG 5  KURTOSIS

PESCADERO CREEK

37° 10'

122° 20'

PIGEON POINT

37° 00'

122° 00'

PT. ANO NUEVO

CONTOUR INTERVAL
10 FATHOMS

SCALE

0  2  4  6  8 MILES

SAN FRANCISCO

MONTEREY BAY

SAN LORENZO RIVER

SANTA CRUZ

ADAPTED FROM
U.S.C.&G.S. CHART 5402
FIG 6 PHI MEDIAN GRAIN DIAMETER

PESCADERO CREEK

37°10'

122°20'

PIGEON POINT

37°00'

PT. ANO NUEVO

CONTOUR INTERVAL
10 FATHOMS

ADAPTED FROM
U.S.C.&G.S. CHART 5402

SCALE

0 2 4 8 MILES

SAN FRANCISCO

MONTEREY BAY

SAN LORENZO RIVER

SANTA CRUZ

37°00'

122°00'
CONTOUR INTERVAL
10 FATHOMS

ADAPTED FROM
U.S.C.&G.S. CHART 5402
References


Sample 2145

Lat. 37° 08.3' Long. 122° 30.1'

Depth 50 Fathoms

91.6 Meters

300 Feet

Sample description greenish gray

very fine grained sandy silt.

Sample Weight 299.659 g

---

SIZE PARAMETERS

1st Mode .044 - .062 mm

Q25 .057 mm

Sorting Coef. 1.51

2nd Mode

Median: Q50 .042 mm

Skewness .808

3rd Mode

Q75 .025 mm

Kurtosis .235
SIZE ANALYSIS

Sample 2146

Lat. 37° 09.5' Long. 122° 27.6'

Depth 40.0 Fathoms

73.2 Meters

240.0 Feet

Sample description greenish

gray very fine grained sandy silt

Sample Weight 274.196 g

Phi Units

100

90

80

70

60

50

40

30

20

10

0

Millimeters 10.0

1.0

0.1

0.01

1st Mode .044 - .062 mm

Q25 .053 mm

Sorting Coef. 1.518

2nd Mode Median: Q50 .038 mm

Skewness .844

3rd Mode Q75 .023 mm

Kurtosis .265
SIZE ANALYSIS

Sample: 2147

Sample description: greenish

Lat.: 37° 10.4' Long.: 122° 26.3'

Sample Weight: 236.736 g

Depth:
- 30.0 Fathoms
- 54.8 Meters
- 180.0 Feet

SIZE PARAMETERS

1st Mode: 0.062 - 0.088 mm

Q_{25}: 0.090 mm

Sorting Coef.: 1.604

2nd Mode: Median: Q_{50}: 0.061 mm

Skewness: 0.847

3rd Mode: Q_{75}: 0.035 mm

Kurtosis: 0.292
### SIZE ANALYSIS

<table>
<thead>
<tr>
<th>Sample</th>
<th>2150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lat.</td>
<td>37° 06.2'</td>
</tr>
<tr>
<td>Long.</td>
<td>122° 28.0'</td>
</tr>
<tr>
<td>Depth</td>
<td>50.0 Fathoms</td>
</tr>
<tr>
<td></td>
<td>91.6 Meters</td>
</tr>
<tr>
<td></td>
<td>300.0 Feet</td>
</tr>
<tr>
<td>Sample description</td>
<td>greenish gray</td>
</tr>
<tr>
<td></td>
<td>very fine grained sandity silt</td>
</tr>
<tr>
<td>Sample Weight</td>
<td>276.513 g</td>
</tr>
</tbody>
</table>

#### SIZE PARAMETERS

<table>
<thead>
<tr>
<th>Mode</th>
<th>Size Range</th>
<th>Q&lt;sub&gt;25&lt;/sub&gt;</th>
<th>Sorting Coef.</th>
<th>Median: Q&lt;sub&gt;50&lt;/sub&gt;</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Mode</td>
<td>0.044 - 0.062 mm</td>
<td>0.057 mm</td>
<td>1.57</td>
<td>0.038 mm</td>
<td>.908</td>
<td>247</td>
</tr>
<tr>
<td>2nd Mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd Mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q&lt;sub&gt;75&lt;/sub&gt;</td>
<td>0.023 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Sample** 2151

**Sample description** greenish gray

very fine grained sandy silt

**Lat.** 37° 07.1'  **Long.** 122° 26.5'

**Depth** 40.0  **Fathoms**

73.2  **Meters**

240.0  **Feet**

**Sample Weight** 161.384 g
SIZE ANALYSIS

Sample 2152
Lat. 37° 08.3' Long. 122° 24.7'
Depth 30.0 Fathoms
54.8 Meters
180.0 Feet
Sample description greenish gray
fine grained silty sand
Sample Weight 252.516 g

SIZE PARAMETERS

1st Mode .062 - .088 mm
2nd Mode
3rd Mode .035 mm
Q25 .082 mm
Median: Q50 .060 mm
Q75 .35 mm
Sorting Coef. 1.53
Skewness .797
Kurtosis .270
Sample 2153

Lat. 37° 09.1'  Long. 122° 23.4'
Depth  20.0  Fathoms
       36.6  Meters
       120.0  Feet

Sample description  gray  colored fine grained silty sand

Sample Weight  196.250 g

SIZE PARAMETERS

1st Mode  .088 - .125 mm  $Q_{25}$ .130 mm  Sorting Coef.  1.52
2nd Mode  .022 - .031 mm  Median: $Q_{50}$ .10 mm  Skewness  .728
3rd Mode

$Q_{75}$ .056 mm  Kurtosis  .280
SIZE ANALYSIS

Sample 2154

Lat. 37° 09.6' Long. 122° 22.5'

Depth 10.0 Fathoms

18.3 Meters

60.0 Feet

Sample description gray colored fine grained sand

Sample Weight 280.895 g

SIZE PARAMETERS

1st Mode .125 - .177 mm

Q25 .180 mm

Sorting Coef. 1.214

2nd Mode

Median: Q50 .150 mm

Skewness .976

3rd Mode

Q75 .122 mm

Kurtosis .228
SIZE ANALYSIS

Sample 2155

Lat. 37° 04.3' Long. 122° 25.7'

Depth 50.0 Fathoms

91.6 Meters

300.0 Feet

Sample description greenish gray

very fine grained sandy silt

Sample Weight 181.190 g

---

SIZE PARAMETERS

1st Mode .044 - .062 mm

Q25 .057 mm

Sorting Coef. 1.574

2nd Mode Median: Q50 .039 mm

Skewness .862

3rd Mode Q75 .023 mm

Kurtosis .276
Sample 2156

Lat. 37° 05.2  Long. 122° 24.7'

Depth 40.0  Fathoms

73.2  Meters

240.0  Feet

Sample description greenish gray

very fine grained sandy silt

Sample Weight 208.419

---

**SIZE PARAMETERS**

1st Mode  .062 - .088 mm

Q_{25} .070 mm  Sorting Coef.  1.456

2nd Mode  

Median:Q_{50} .054 mm  Skewness  .792'

3rd Mode  

Q_{75} .033 mm  Kurtosis  .245
SIZE ANALYSIS

Sample 2157
Lat. 37° 06.2' Long. 122° 22.8'
Depth 30.0 Fathoms
54.8 Meters
180.0 Feet
Sample description greenish gray
fine grained silty sand
Sample Weight 168.141 g

SIZE PARAMETERS

1st Mode .088 -.125 mm  Q25 .096 mm  Sorting Coef. 1.460
2nd Mode .0156 -.022 mm Median:Q50 .078 mm Skewness .710
3rd Mode Q75 .045 mm  Kurtosis .277

Millimeters 10.0 1.0 0.1 0.01

Phi Units -3 -2 -1 0 +1 +2 +3 +4 +5 +6

Weight Percent
Sample 2158
Lat. 37° 06.8'  Long. 122° 21.8'
Depth 20 Fathoms
       36.6 Meters
       120.0 Feet
Sample description  gray colored
fine grained sand with abundant
coarse shell material and a few
assorted pebbles
Sample Weight 153.081 g

SIZE PARAMETERS
1st Mode  .088 - .175 mm
2nd Mode  2.88 - 4.00 mm
3rd Mode

Q25 .140 mm  Sorting Coef. 1.177
Median:Q50 .120 mm  Skewness .982
Q75 .101 mm  Kurtosis .193
Sample 2159
Lat. 37° 07.1' Long. 122° 21.3'
Depth 10.0 Fathoms
       18.3 Meters
       60.0 Feet
Sample description coarse grained
sand and pebbles, consisting of
large shell and rock frag., from
tidal channel lag deposit?
Sample Weight 126.964 g.

---

SIZE PARAMETERS

1st Mode .991 - 1.397 mm  Q_{25} 1.58 mm  Sorting Coef. 1.405
2nd Mode  
3rd Mode  Q_{75} .80 mm  Skewness .956  Kurtosis .229
Sample 2160

Lat. 37° 02.7' Long. 122° 22.8'

Depth 50.0 Fathoms

91.6 Meters

300.0 Feet

Sample description greenish gray very fine grained sandy silt

Sample Weight 224.874 g

SIZE PARAMETERS

1st Mode .031 - .044 mm

Q25 .063 mm

Sorting Coef. 1.692

2nd Mode

Median: Q50 .040 mm

Skewness .866

3rd Mode

Q75 .022 mm

Kurtosis .233
Sample 2161

Sample description greenish gray

Lat. 37° 03.5' Long. 122° 21.7'

Depth 40.0 Fathoms

73.2 Meters

240.0 Feet

Sample Weight 220.335 g

SIZE PARAMETERS

1st Mode .062 - .088 mm

Q25 .068 mm

Sorting Coef. 1.719

2nd Mode .031 - .044 mm

Median: Q50 .040 mm

Skewness .977

3rd Mode

Q75 .023 mm

Kurtosis .302
Sample 2162

Lat. 37° 04.3'  Long. 122° 20.4'

Depth 30.0  Fathoms

54.8  Meters

180.0  Feet

Sample description greenish

gray fine grained silty sand

Sample Weight 206.932 g

---

**SIZE PARAMETERS**

1st Mode  .062 - .088 mm  
2nd Mode  
3rd Mode  

$Q_{25} .095$ mm  
Median: $Q_{50} .073$ mm  
$Q_{75} .042$ mm  

Sorting Coef. 1.503  
Skewness .749  
Kurtosis .252
SIZE ANALYSIS

Sample 2163
Sample description greenish gray

Lat. 37° 05.1' Long. 122° 19.3'

Depth 20.0 Fathoms
36.6 Meters
120.0 Feet

Sample Weight 200.667 g

SIZE PARAMETERS

1st Mode .044 - .062 mm
2nd Mode .022 - .031 mm
3rd Mode .351 - .495 mm

$Q_{25} .080 \text{ mm}$
$Q_{50} .045 \text{ mm}$
$Q_{75} .020 \text{ mm}$

Sorting Coef. 2.000
Skewness .790
Kurtosis .192
Sample 2164
Lat. 37° 05.7'  Long. 122° 18.2'
Depth 10.0 Fathoms
       18.3 Meters
       60.0 Feet
Sample description gray
colored fine grained sandy silt
Sample Weight 210.418 g.

Phi Unit

100
90
80
70
60
50
40
30
20
10
0

Millimeters 10.0 1.0 0.1 0.01

SIZE PARAMETERS
1st Mode .062 -.088 mm
2nd Mode
3rd Mode
Q_{25} .080 mm
Median: Q_{50} .051 mm
Q_{75} .027 mm
Sorting Coef. 1.721
Skewness .830
Kurtosis .257
Sample 2165
Lat. 37° 06.2'  Long. 122° 17.7'
Depth 5.0 Fathoms
9.2 Meters
30.0 Feet
Sample description  gray
colored fine grained sand
Sample Weight 268.049 g

SIZE PARAMETERS
1st Mode .062 - .088 mm
Q_{25} .149 mm  Sorting Coeff. 1.185
2nd Mode
Median:Q_{50} .122 mm  Skewness 1.06
3rd Mode
Q_{75} .106 mm  Kurtosis .239
Sample 2166
Lat. 37° 06.5' Long. 122° 18.6'
Depth 6.7 Fathoms
12.2 Meters
40.0 Feet
Sample description greenish
gray fine grained sand
Sample Weight 129,831 g

SIZE PARAMETERS
1st Mode .088 - .125
Q25 .119 mm
Sorting Coef. .243
2nd Mode
Median:Q50 .100 mm
Skewness .916
3rd Mode
Q75 .077 mm
Kurtosis .269
SIZE ANALYSIS

Sample 2167

Lat. \(37° 00.9'\) Long. \(122° 20.6'\)

Depth 50.0 Fathoms

91.6 Meters

300.0 Feet

Sample description greenish

gray very fine grained silty sand

Sample Weight 183.354 g

---

**SIZE PARAMETERS**

1st Mode \(0.088 - 0.125\) mm

2nd Mode \(0.044 - 0.062\) mm

3rd Mode \(0.008 - 0.11\) mm

\(Q_{25} = 0.096\ mm\)

\(Q_{50} = 0.060\ mm\)

\(Q_{75} = 0.030\ mm\)

Sorting Coef. 1.788

Median

Skewness 0.800

Kurtosis 0.284
Sample 2168
Lat. 37° 01.7' Long. 122° 19.4'
Depth 40.0 Fathoms
73.2 Meters
240.0 Feet
Sample description greenish
gray very fine grained sandy silt
Sample Weight 254.843 g

SIZE PARAMETERS
1st Mode .044 - .062 mm
2nd Mode
3rd Mode
Q25 .076 mm
Median:Q50 .055 mm
Skewness .703
Q75 .028 mm
Kurtosis .800

Size Analysis
Sample 2169
Lat. 37° 02.6'  Long. 122° 17.8'
Depth 30.0 Fathoms 54.8 Meters 180.0 Feet
Sample description greenish gray fine grained sandy silt
Sample Weight 207.578 g

SIZE PARAMETERS
1st Mode .088 - .125 mm
2nd Mode .031 - .044 mm
3rd Mode

Q25 .100 mm  Sorting Coef. 1.543
Median:Q50 .079 mm  Skewness .673
Q75 .042 mm  Kurtosis .293
Sample 2170
Lat. 37° 03.3' Long. 122° 16.9'
Depth 20.0 Fathoms
       36.6 Meters
       120.0 Feet
Sample description gray colored fine grained sand
Sample Weight 202.423 g

SIZE PARAMETERS
1st Mode .088 - .125 mm
2nd Mode .351 - .495 mm
3rd Mode
Q25 .135 mm
Median: Q50 .105 mm
Q75 .080 mm
Sorting Coef. 1.300
Skewness .976
Kurtosis .275
Sample 2171

Lat. 37° 03.7' Long. 122° 16.4'

Depth 15.0 Fathoms
       27.4 Meters
       90.0 Feet

Sample description gray
      colored fine grained sand

Sample Weight 175.391 g

### SIZE PARAMETERS

<table>
<thead>
<tr>
<th>Mode</th>
<th>Size Range</th>
<th>Q25</th>
<th>Sorting Coef.</th>
<th>Median</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Mode</td>
<td>.088 -.125 mm</td>
<td>.140 mm</td>
<td>1.214</td>
<td>.118 mm</td>
<td>.955</td>
<td>.234</td>
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<tr>
<td>2nd Mode</td>
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<tr>
<td>3rd Mode</td>
<td></td>
<td>Q75</td>
<td></td>
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</tr>
</tbody>
</table>

Millimeters 10.0  1.0  0.1  0.01

Weight Percent
Sample 2172  
Lat. 37°03.9' Long. 122° 15.9'  
Depth 10.0 Fathoms 18.3 Meters 60.0 Feet  
Sample description gray colored fine grained sand with some shell material and a few rock fragments  
Sample Weight 4.1717 g

SIZE PARAMETERS

1st Mode .088 - .125 mm  
2nd Mode 7.0 - 10.0 mm  
3rd Mode .381 - .495 mm  
Q_{25} .130 mm  
Median:Q_{50} .110 mm  
Q_{75} .104 mm  
Sorting Coef. 1.118  
Skewness 1.117  
Kurtosis .033
SIZE ANALYSIS

Sample 2173
Sample description greenish gray

Lat. 36° 58.8'  Long. 122° 18.0'
very fine grained sandy silt with

Depth 50.0 Fathoms  much glauconite
91.6 Meters
300.0 Feet
Sample Weight 204.204 g

SIZE PARAMETERS

1st Mode 0.08 - 0.125 mm  Q_{25} 0.100 mm  Sorting Coef. 1.715
2nd Mode 0.044 - 0.062 mm  Median: Q_{50} 0.059 mm  Skewness 0.977
3rd Mode 0.008 - 0.011 mm  Q_{75} 0.034 mm  Kurtosis 0.284
Sample 2174

Lat. 36° 59.7' Long. 122° 17.1'

Depth 40.0 Fathoms

73.2 Meters

240.0 Feet

Sample description greenish

Sample Weight 162.003 g

**SIZE PARAMETERS**

1st Mode .125 - .177 mm

2nd Mode .044 - .062 mm

3rd Mode

Q_{25} .130 mm

Median: Q_{50} .097 mm

Q_{75} .047 mm

Sorting Coef. 1.663

Skewness .649

Kurtosis .287
Sample 2175  
Sample description greenish gray  
Sample Weight 161.922 g  
Lat. 37° 00.8' Long. 122° 15.6'  
Depth 30.0 Fathoms  
54.8 Meters  
180.0 Feet  

SIZE PARAMETERS  
1st Mode .088 - .125 mm  
Q_{25} .126 mm  
Sorting Coef. 1.361  
2nd Mode .0156 - .022 mm  
Median:Q_{50} .108 mm  
Skewness .735  
3rd Mode Q_{75} .068 mm  
Kurtosis .223
Sample  2176

Lat. 37° 01.3'  Long. 122° 14.8'

Depth  20.0  Fathoms
        36.6  Meters
        120.0  Feet

Sample description  greenish gray
fine grained sand

Sample Weight  144,890 g

SIZE PARAMETERS

1st Mode  .125 - .177 mm  Q_{25} .141 mm  Sorting Coef.  1.159
2nd Mode  Median: Q_{50} .125 mm  Skewness  .947
3rd Mode  Q_{75} .105 mm  Kurtosis  .165
Sample 2177
Lat. 37° 01.8' Long. 122° 14.1'
Depth 10 Fathoms
18.3 Meters
60.0 Feet
Sample description gray colored
fine grained sand with occasional small pebbles
Sample Weight 122.004 g

SIZE PARAMETERS
1st Mode 1.981 - 2.80 mm  Q25 .180 mm  Sorting Coef. 1.268
2nd Mode  Median: Q50 .140 mm  Skewness 1.03
3rd Mode  Q75 .112 mm  Kurtosis .234
Sample 2178

Sample description greenish gray
very fine grained sandy silt
with much glauconite and
common large glauconite aggregates
Sample Weight 236.795 g

SIZE PARAMETERS

1st Mode .031 - .044 mm  Q_{25} .043 mm  Sorting Coef. 1.640
2nd Mode .062 - .088 mm Median:Q_{50} .028 mm  Skewness .878
3rd Mode Q_{75} .016 mm  Kurtosis .190
Sample 2179
Lat. 36° 57.9' Long. 122° 14.0'
Depth 40.3 Fathoms
74.4 Meters
242.0 Feet
Sample description greenish gray
very fine grained sandy silt
Sample Weight 248.859 g

SIZE PARAMETERS
1st Mode .031 - .044 mm
2nd Mode
3rd Mode

Q25 .043 mm
Median:Q50 .033 mm
Q75 .017 mm

Sorting Coef. 1.590
Skewness .671
Kurtosis .233
Sample 2180

Sample description: greenish gray
fine grained silty sand

Lat. 36° 58.7' Long. 122° 13.1'

Depth 30.0 Fathoms
54.8 Meters
180.0 Feet

Sample Weight 32.772 g

---

**SIZE PARAMETERS**

1st Mode .088 - .125 mm  
2nd Mode .022 - .031 mm  
3rd Mode .351 - .495 mm

Q_{25} .125 mm  
Median: Q_{50} .100 mm  
Q_{75} .073 mm

Sorting Coef. 1.309  
Skewness .913  
Kurtosis .202
Sample 2181

Sample description greenish gray
fine grained silty sand with
some very small pebbles

Sample Weight 171.962 g

SIZE PARAMETERS

1st Mode .088 - .125 mm

Q25 .133 mm

Sorting Coef. 1.171

2nd Mode .351 - .495 mm

Median: Q50 .120 mm

Skewness .896'

3rd Mode

Q75 .097 mm

Kurtosis .225
Sample 2182

Lat. 37° 00.1' Long. 122° 11.8'

Depth 10 Fathoms
18.3 Meters
60.0 Feet

Sample description gray colored fine grained sand with some shell material

Sample Weight 22.909 g

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**SIZE PARAMETERS**

1st Mode \(0.088 - 0.125 \text{ mm}\)  
2nd Mode \(0.351 - 0.495 \text{ mm}\)  
3rd Mode 

\(Q_{25} = 0.138 \text{ mm}\)  
\(Q_{50} = 0.115 \text{ mm}\)  
\(Q_{75} = 0.100 \text{ mm}\)

Sorting Coef. 1.174  
Skewness 1.04  
Kurtosis 0.218
Sample 2183

Lat. 36° 55.2'  Long. 122° 11.7'

Depth 48.3  Fathoms
88.4  Meters
290.0  Feet

Sample description  greenish gray very fine grained sandy silt

Sample Weight 239.688 g

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### SIZE PARAMETERS

<table>
<thead>
<tr>
<th>Mode</th>
<th>Size Range</th>
<th>Q25</th>
<th>Sorting Coef.</th>
<th>Skewness</th>
<th>Kurtosis</th>
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</thead>
<tbody>
<tr>
<td>1st Mode</td>
<td>.044 - .062 mm</td>
<td>.047 mm</td>
<td>1.714</td>
<td>.734</td>
<td>.275</td>
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<tr>
<td>2nd Mode</td>
<td>Median: Q50 .032 mm</td>
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<tr>
<td>3rd Mode</td>
<td>Q75 .016 mm</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
Sample 2184
Lat. 37° 00.0' Long. 122° 11.7
Depth Intertidal Fathoms
" Meters
" Feet
Sample description medium to fine beach sand
Sample Weight 257.335 g.

SIZE PARAMETERS
1st Mode .246 - .351 mm  Q_{25} .380 mm  Sorting Coef. 1.314
2nd Mode  Median:Q_{50} .285 mm  Skewness 1.029
3rd Mode Q_{75} .220 mm  Kurtosis .262
SAMPLE DESCRIPTION

Sample 2185
Lat. 37° 01.5' Long. 122° 12.9'
Sample description medium size
beach sand

Depth Intertidal Fathoms
Meters
Feet
Sample Weight 363.205 g

SIZE PARAMETERS

1st Mode .351 - .495
2nd Mode
3rd Mode

\[ Q_{25} = .80 \text{ mm} \]
\[ Q_{50} = .53 \text{ mm} \]
\[ Q_{75} = .43 \text{ mm} \]

Sorting Coef. 1.364
Skewness 1.224
Kurtosis .228
Sample 2186
Lat. 37° 02.5' Long. 122° 13.7'
Depth Intertidal Fathoms
" " Meters
" " Feet
Sample description medium to coarse beach sand with occasional small pebbles
Sample Weight 555.499 g

SIZE PARAMETERS
1st Mode .351 - .495 mm  Q25 1.46 mm  Sorting Coef. 2.136
2nd Mode 1.41 - 2.00 mm  Median:Q50 .45 mm  Skewness 2.307
3rd Mode 5.80 - 8.00 mm  Q75 .32 mm  Kurtosis .214
Sample 2188

Lat. 37° 04.7'  Long. 122° 15.8'

Depth Fathoms

" Meters

" Feet

Sample description medium size

beach sand

Sample Weight 389,730 g

SIZE PARAMETERS

1st Mode .351 - .495 mm  Q25 .64 mm  Sorting Coef. 1.265

2nd Mode  Median:Q50 .48 mm  Skewness 1.111

3rd Mode  Q75 .40 mm  Kurtosis .203
Sample 2189
Lat. 37° 05.8' Long. 122° 16.6'
Depth Intertidal Fathoms
" Meters
" Feet
Sample description fine beach
sand
Sample Weight 201.876 g

Phi Units

100 90 80 70 60 50 40 30 20 10 0

Millimeters 10.0 1.0 0.1 0.01

SIZE PARAMETERS
1st Mode .177 - .246
Q_{25} .255 \text{ mm}  Sorting Coef. 1.190
2nd Mode
Median: Q_{50} .220 \text{ mm}  Skewness .948
3rd Mode
Q_{75} .180 \text{ mm}  Kurtosis .223
SIZE ANALYSIS

Sample: 2191

Sample description: fine to medium beach sand with medium sized pebbles

Lat. 37° 07.0'  Long. 122° 18.3'

Depth: Intertidal Fathoms

Sample Weight: 548.051 g

Phi Units

-3 -2 -1 0 +1 +2 +3 +4 +5 +6

Millimeters 10.0 1.0 0.1 0.01

SIZE PARAMETERS

1st Mode: .177 - .246 mm  Q25: .380 mm  Sorting Coef. 1.378

2nd Mode: .351 - .495 mm  Median: Q50: .220 mm  Skewness 1.57

3rd Mode: 2.83 - 4.00 mm  Q75: .200 mm  Kurtosis .070
Sample 2192
Lat. 37° 08.7' Long. 122° 20.7'
Depth Intertidal Fathoms
" " Meters
" " Feet
Sample description Fine to medium beach sand
Sample Weight 107.932

SIZE PARAMETERS
1st Mode .177 - .246 mm
2nd Mode .351 - .495 mm
3rd Mode
Q25 .225 mm
Median: Q50 .192 mm
Q75 .165 mm
Sorting Coef. 1.168
Skewness 1.007
Kurtosis .229
Sample  2194

Lat. 37° 10.4'  Long. 122° 22.0'

Depth Intertidal Fathoms

Sample description  fine beach

sand with small pebbles

Sample Weight 419.825

SIZE PARAMETERS

1st Mode  .177 - .246 mm

Q25  .315 mm  Sorting Coef.  1.271

2nd Mode  5.80 - 8.00 mm

Median: Q50  .241 mm  Skewness  1.058

3rd Mode

Q75  .195 mm  Kurtosis  .214
SIZE ANALYSIS

Sample 2195
Lat. 37° 11.6' Long. 122° 23.8'
Depth Intertidal Fathoms

Sample description medium to coarse beach sand

Sample Weight 390.322

Phi Units

-3 -2 -1 0 +1 +2 +3 +4 +5 +6

100 90 80 70 60 50 40 30 20 10 0

Millimeters 10.0 1.0 0.1 0.01

SIZE PARAMETERS

1st Mode 0.351 - 0.495 mm  Q_{25} 0.930 mm  Sorting Coef. 1.488
2nd Mode Median: Q_{50} 0.600 mm  Skewness 1.085
3rd Mode Q_{75} 0.420 mm  Kurtosis 0.229