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Sediment Grain-Size Distribution in the Çiftlık Plain-(Ovalıbağ, Melendiz and Imamhatip) Nigde Province, Turkey

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Abstract

As a very important textural characteristic, grain size has been widely used by geologists to determine the distance a piece of sediment must have taken before coming to a halt.Sediments,be they clastic or chemical, is determined by their methods of erosion. Clastic sediments being broken down through physical means like water, wind, ice by abrasion. These may give rise to pebbles/gravels,sand,silt and clays.So,to interpret the geomorphological settings of the Çiftlik Basin(paleo or present);sediments must have either been transported from regional to local settings or from within the local settings.Natural characteristics of sediments with recognized grain size composition have been classified using the Udden-Wentworth grain size scale(phi= Φ).This is the method that facilitates statistical analysis, graphical representation and geological representation of terrestrial sediments of Ovalıbağ, Melendiz and Imamhatip of the Çiftlik Basin. A total of 158 samples were investigated and detailed grain size analysis were done on 41 selected samples. The Ovalıbağ (750 cm) OVA1 to OVA15 samples, Melendiz (661 cm) MEL1 to MEL10 samples and Imamhatip (860 cm) IMA1 to IMA 16 samples. The Phi (Φ) values ranges from Φ= -3 to Φ=5; from very coarse to very fine grains. Most of the grain sizes were coarse skewed and very poorly sorted, indicative of intra-locality origin of most of the sediments. Skewness which is the measure of symmetry and can either be positive (fine), negative (coarse) or symmetrical. The grain-sizes used are as follows;≤ 0.062mm(Φ=5)clays and muds,0.062mm(Φ=4) silt,0.125mm(Φ=3)fine sand,0.25mm(Φ=2)medium sand,0.5mm(Φ=1)coarse sand,1mm(Φ=0)very coarse sand,≤2mm(Φ=-1)granules,4mm(Φ=-2)gravels,8mm(Φ=-3) pebbles. Their sorting results are as follows; very poorly sorted=7 samples and poorly sorted =34 samples while their skewness is; very fine skew=10 samples, coarse skew=3 samples and very coarse skew=28 samples.

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1. Introduction

The significance and importance of grain size amongst other physical properties of sediments like shape and roundness cannot be over emphasized. This research therefore establishes how graphical statistical representation can be used to describe/analyze grain size distribution in selected areas of the Çiftlik Basin. The primary objective of this research therefore, is to evaluate the grain size distribution in the Çiftlik Basin by determining weight percentage values of pebbles/gravels, sand, silt and clay and their textures using statistical methods which could help in the correlation of data obtained and can be compared to adjacent areas to these in the future. The Udden-Wentworth grain size scale was used though it inadequately covers gravel in alluvial fans. According to [10], grain size is one of the most important sediment parameters and it is necessary to interpret the depositional environments [5].According to [3], grain size is the maximum elemental natural equity of sedimentary deposits.[12, 13],According to the authors [15, 7] devised the phi scale (Φ), based on the equation Φ=-$\log_2$ of the grain *dI* in mm, to convert the sediment grade boundary values from fractional numbers to more simple whole numbers.Equally,according to [1] ,grain size is a useful proxy for reconstructing paleoclimate. Ice-rafting releases sediment as icebergs calve and melt [10].The grain sizes of sediments provide an indication of the shear stress that must be applied by the medium to initiate and sustain particle movement [19].Grain size help geologists to interpret the geomorphic (both historical and present) of a site,irrespective of whether the sediment was transported there from local or regional settings.According to [15],the use of sieves for size analysis dictates that the intermediate axial length (*d*I) of a grain is the one that determines classification (e.g.in,[4]). The median represents the grain size at 50%,while the mean is the average value gotten from computing the grain-sizes at 16^{th},50^{th} and 84^{th} percentiles on the Ford and ward scheme, sorting being the spread of grain size distribution and finally, skewness which is the measure of symmetry and can either be positive (fine), negative (coarse) or symmetrical. . It can be characterized using standard statistical measures in either of two ways: (1) visual inspection of various types of graphs that plot overall percent abundance versus grain-size diameter(diagrams, size frequency and cumulative size frequency curves, and probability curves that compare the actual grain-size distribution to a normal straight-line Gaussian distribution[9]. The Çiftlik plain is made up of Quaternary paleosol and terrestrial sediments which maybe fluvial,lacustrine,swamp or floodplain sediments made up of pebbles/gravels, sand, silt and clay which may have been modified by pedogenic processes. This area is found in the middle of the Central Anatolian Cappadocian Volcanic Province of Turkey. The grain size of a clastic sediment indicates the relative amount of energy required to emplace the grains in their final resting place. Energy may have come from the force transmitted by air/water/glacier movement or due to downward movement by gravity. Grain size may equally be due to diagenetic crystal growth not link to transportational processes especially in siliciclastic sediments. Their distribution in this basin is not uniform and shows that the hydrodynamic conditions were strong which helps to explain the transport trends of these varied sediments. The grain sizes of these three (3) localities in the Çiftlik basin will be considered for this research,viz Ovalıbağ, Melendiz and Imamhatip. The primary objective of this research is to evaluate the grain size distribution in the Çiftlik basin by determining weight percentage values of pebbles/gravels, sand, silt and clay and their textures using statistical methods which could help in the correlation of data obtained and can be compared to adjacent areas to these in the future. The second part of the research included statistical analysis, visualizing and plotting results by means of R programming language. After the grain-size analysis by Master sizer, a given sediment has been determined by statistical analysis. It can be characterized using standard statistical measures in either of two ways: (1) visual inspection of various types of graphs that plot overall percent abundance versus grain-size diameter (diagrams, size frequency and cumulative size frequency curves, and probability curves that compare the actual grain-size distribution to a normal straight-line Gaussian distribution)

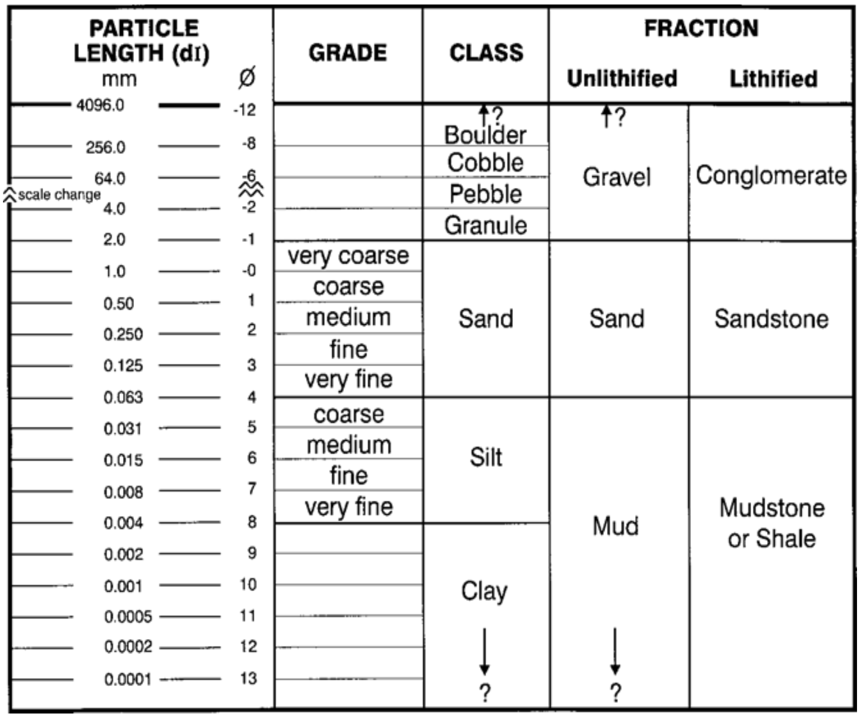

Figure 1: Widely used Udden–Wentworth sedimentary grain-size scale (after [17,4];and according to [15]).

The majority of these sediments were poorly sorted and made up of very fine and coarse skewness which indicates a very strong environmental change. The positive and negative sign of the skewness value indicates whether the asymmetrical tail extends to the left or right of the curve, as follows [4]. The grain sizes ranges from 16 mm to 0.008 mm.The weight percentages of the selected sediments were represented on graphs using statistical methods.

2. Methods

Soil samples taken from the field were prepared for the following analytical methods after drying in an oven at 60 ºC for 24 hours, passing through a 2 mm sieve. Sample grain size analysis of 15 Ovalıbağ (Figures 2-17), 10 Melendiz (Figures 18-27) and 16 Imamhatip (Figures 28-43) profiles, which can represent the sediments in the Çiftlik plain, is 6 because it represents the lake shore or delta environment. 2 profiles were selected by making a preliminary examination from the locality. The above-mentioned raw samples were first subjected to air drying. The dried samples with grain sizes from 16 mm to 0.008 mm were passed through special sieves. In addition, grains smaller than 0.008 mm were divided into two parts as coarse and fine clay by Atarberg method. Gravel % weight, sand % weight and silt-clay % weight of the samples separated according to grain size are given in Figures 1-26. Also, the columns giving their % cumulative weight are given in the same table. The table here is the average grain size values obtained only at certain intervals. Using the tabular data in Figures 2-43, the cumulative percentages of gravel, sand and silt-clay in the samples were plotted on millimetric paper to correspond to their grain sizes. Median diameter (Md), graphical standard deviation (Gϕ = degree of height), and first order tail (Sk = asymmetric degree of distribution), known as Folk and Ward (1957) parameters, were calculated from the obtained graphs. The Folk and Ward parameters calculated in this way are again given in Figures 2-43. The following comments are used to interpret Table 1, that is, the degree of gradation (Gϕ, and Table 2, to interpret the asymmetrical degree of the sediment distribution (trapezoid, Sk). By using the Inman parameters calculated in this way, their sorting and the shape of the grain size distribution were determined. For the Ovalıbağ profile: Based on previous grain size analyzes and field studies, these calculations were determined that the unconsolidated sediments and paleosols that could represent the sediments in the Ovalıbağ region are poorly or poorly sorted. This shows us that different types of grain size sediments (clay-silt-mud-sand-gravel) were transported to this region and subsequently deposited in the same river or lake shore environment. In situ weathering, on the other hand, shows that the decomposed minerals and rock fragments are in very different sizes. Likewise, very fine or very coarse skewness values also support the above-mentioned results. For the samples from the Melendiz region: In the examinations made in addition to the profile examinations, it was determined that the samples taken from the surface levels were poorly sorted. On the other hand, all samples were determined to have negative values. They generally show strong roughness. These various and different values have been formed as a result of river flows, changes in lacustrine inputs and climate change in the region. In other words, the presence of unconsolidated sediments with a wide variety of lithological characteristics and the differences in transport mechanisms (lake and terrestrial grain inputs) in the region prove. Since the sand and gravel levels are worked on the lake shore, they show good sorting, here the delta or river bank (flood plain) sediment is poorly sorted. The rapid change of some levels in the profiles can only be explained by climate changes. Briefly, this lake is fed by delta and alluvial fans, streams and another lake. The skewness values also support the above results. For Imamhatip profile: These calculations are based on previous grain size analyzes and field studies, and it has been determined that unconsolidated sediments and paleosol that can represent sediments in Imamhatip region are poorly sorted. This shows us that different types of grain size sediments (clay-silt-mud-sand-gravel) were transported to this region and subsequently deposited in the same river or lake shore environment. In situ weathering, on the other hand, shows that the decomposed minerals and rock fragments are in very different sizes. Likewise, very fine or very coarse skewness values also support the above-mentioned results.

Table 1: Grade of sorting (Gϕ) and interpretation and condition of the examined samples.

< 0.35 Very well sorted
0.35-0.5 Well sorted
0.5-0.71 Moderately well sorted
0.71-1.0 Moderately sorted
1.0-2.0 Poorly sorted [(OVA-1, OVA-2, OVA-3, OVA-4, OVA-5, OVA-6, OVA-7, OVA-8, OVA-9,OVA-10, OVA-11, OVA-13) , OVA-14, OVA-15, MEL-1, MEL-2, MEL-7, MEL-8, MEL-9, MEL-10, IMA-1, IMA-2, IMA-3, IMA-4, IMA -6, IMA-7, IMA-8, IMA-9, IMA-11, IMA-12, IMA-13, IMA-14,IMA-15, IMA-16)]
> 2.0 Very poorly sorted, (OVA-12, MEL-3, MEL-4, MEL-5, MEL-6, IMA-5, IMA-10)

Table 2: Distribution asymmetric degree Sk(skewness) and interpretation and the condition of the examined samples.

> 0.30 Very fine – skew, (OVA-9, MEL-5, MEL-7, MEL-8, IMA-5, IMA-6, IMA-7, IMA-8, IMA-10, IMA-11)
0.30-0.10 Fine - skew
0.10- (-0.10) Approximately symmetrical
(-0.10) – (-0.30) Coarse – skew, (MEL-1, IMA-3, IMA-4)
< (-0.30) Very coarse – skew, (OVA-1, OVA-2, OVA-3, OVA-4, OVA-5, OVA-6,OVA-7, OVA-8, OVA-10, OVA-11, OVA-12 , OVA-13, OVA-14, OVA-15,MEL-2, MEL-3, MEL-4, MEL-6, MEL-9, MEL-10, IMA-1, IMA-2, IMA-9, IMA -12, IMA-13, IMA-14, IMA-15, IMA-16)

3. Results

4. Sediment Distribution Graphs

Sediments can be sourced from varied different locations and deposited as the current in question slows. The sediments here show predominantly coarse and poorly sorted grains which shows that they may not have undergone prolonged transportation before they were deposited, meaning their source is around the basin. In paleo-climate reconstruction, grain size is a very useful proxy. So, environmental information in siliciclastic sediments can be interpreted using grain sizes as well as local vertical variations.Analyzing the grain size, the character or the origin of the sediments can be determined. The formulae therefore used to calculate the grain-size parameters in this case is the Folk & Ward formula with graphic presentations against cumulative frequency plots on a millimetric graph paper. These formulae are detailed below:

Parameter	**Folk & Ward formula**
Median	$Md=\Phi_{50}$
Mean	$M=(\Phi_{16}+ \Phi_{50}+\Phi_{84})/3)$
Sorting	$\sigma\varphi =\Phi_{84} - \Phi_{16}/ 4 + \Phi_{95} - \Phi_{5} / 6.6$
Skewness	$Sk=[\Phi_{16}+\Phi_{84}-2\Phi_{50}/2(\Phi_{84}- \Phi_{16})] + [\Phi_{5}+ \Phi_{95}-2\Phi_{50}/2(\Phi_{95}- \Phi_{5})]$

5. Ovalıbağ Sediments analysis

OVA 1	(ϕ)	Weight %	%	Cum %
6 (< 0.062 mm)	5	19.63	20.00	100.00
5 (0.062 mm)	4	59.41	60.00	80.00
4 (0.125 mm)	3	2.60	3.00	20.00
3 (0.25 mm)	2	12.8	13.00	17.00
2 (0.5 mm)	1	2.20	2.00	4.00
1 (1 mm)	0	2.30	2.00	2.00
TOTALS		98.94	100.00	

Statistics		Comment 1
Md (median)	0.90	
M (mean)	3.23	
Sorting	1.19	poorly sorted
Skewness	-2.14	very coarse skew

data	*OVA 1*
$(\phi)_5$	1.1
$(\phi)_{16}$	2.0
$(\phi)_{50}$	3.5
$(\phi)_{84}$	4.2
$(\phi)_{95}$	5.3

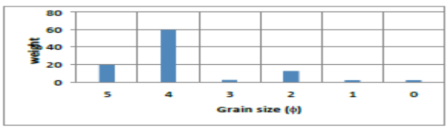

Figure 2: Sieve analysis results of OVA 1 sample and their chart-graphical representation.

OVA 2

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*OVA 2*
6 (< 0.062 mm)	5	19.00	20.00	100.00	Md (median)	1.50		ϕ5	0
5 (0.062 mm)	4	39.45	40.00	80.00	M (mean)	2.73		ϕ16	0.8
4 (0.125 mm)	3	12.95	13.00	40.00	Sorting	1.56	Poorly sorted	ϕ50	3.2
3 (0.25 mm)	2	7.17	7.00	27.00	Skewness	-6.38	Very coarse skew	ϕ84	4.2
2 (0.5 mm)	1	14.75	15.00	20.00				ϕ95	4.7
1 (1 mm)	0	4.85	5.00	5.00					
TOTALS		98.17	100.00						

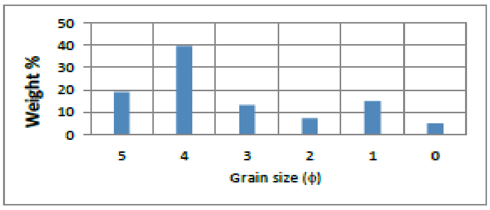

Figure 3: Sieve analysis results of OVA 2 sample and their chart-graphical representation.

OVA 3

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*OVA 3*
8 (< 0.062 mm)	5	27.71	28.00	100.00	Md (medyan)	2.40		ϕ5	-0.15
7 (0.062 mm)	4	27.53	28.00	72.00	M (ortalama)	2.63		ϕ16	0.2
6 (0.125 mm)	3	12.17	12.00	44.00	Sorting	1.80	Poorly sorted	ϕ50	3.3
5 (0.25 mm)	2	10.95	10.00	32.00	Skewness	-9.03	Very coarse skew	ϕ84	4.4
4 (0.5 mm)	1	7.37	8.00	22.00				ϕ95	4.8
3 (1 mm)	0	10.75	10.00	14.00					
2(< 4mm)	-1	2.00	2.00	4.00					
1(≥8mm)	-3	2.00	2.00	2.00					
TOTALS		100.48	100.00						

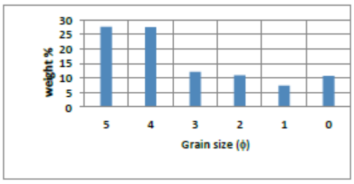

Figure 4: Sieve analysis results of OVA 3 sample and their chart - graphical representation.

OVA 4

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*OVA 4*
6 (< 0.062 mm)	5	38.71	40.00	100.00	Md (median)	2.40		ϕ5	0
5 (0.062 mm)	4	39.53	40.00	60.00	M (mean)	3.35		ϕ16	2.15
4 (0.125 mm)	3	5.17	5.00	20.00	Sorting	1.35	Poorly sorted	ϕ50	3.3
3 (0.25 mm)	2	4.95	5.00	15.00	Skewness	-3.98	Very coarse skew	ϕ84	4.6
2 (0.5 mm)	1	4.37	5.00	10.00				ϕ95	4.9
1 (1 mm)	0	5.75	5.00	5.00					
TOTALS		98.48	100.00						

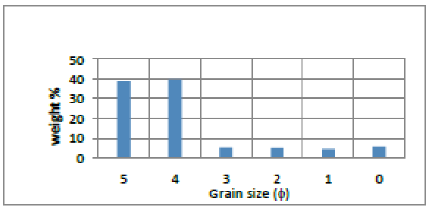

Figure 5: Sieve analysis results of OVA 4 sample and their chart - graphical representation.

OVA 5

Sieve No	(ϕ)	weight %	%	Cum %	Statistics		Comment 1	data	*OVA 5*
6 (< 0.062 mm)	5	18.6	20.00	100.00	Md (median)	1.60		$(\phi)_5$	0
5 (0.062 mm)	4	30	30.00	80.00	M (mean)	2.40		$(\phi)_{16}$	0
4 (0.125 mm)	3	11.66	13.00	50.00	Sorting	1.76	poorly sorted	$(\phi)_{50}$	3
3 (0.25 mm)	2	13.4	12.00	37.00	Skewness	-6.82	very coarse skew	$(\phi)_{84}$	4.2
2 (0.5 mm)	1	7.95	8.00	25.00				$(\phi)_{95}$	4.71
1 (1 mm)	0	17.18	17.00	17.00					
TOTALS		98.79	100.00						

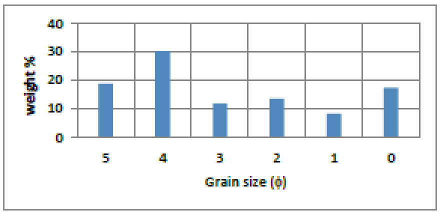

Figure 6: Sieve analysis results of sample OVA 5 and their chart - graphical representation.

OVA 6

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*OVA 6*
6 (< 0.062 mm)	5	60.00	60.00	100.00	Md (median)	1.60		ϕ5	0.2
5 (0.062 mm)	4	29.7	30.00	40.00	M (mean)	3.99		ϕ16	3.2
4 (0.125 mm)	3	2.00	2.00	10.00	Sorting	1.05	Poorly sorted	ϕ50	4.15
3 (0.25 mm)	2	2.00	2.00	8.00	Skewness	-7.94	Very coarse skew	ϕ84	4.61
2 (0.5 mm)	1	2.90	3.00	6.00				ϕ95	4.8
1 (1 mm)	0	3.10	3.00	3.00					
TOTALS		99.7	100.00						

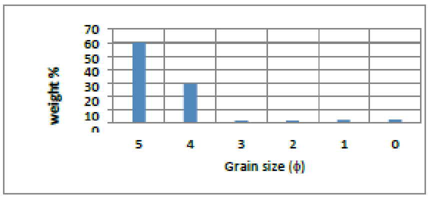

Figure 7: Sieve analysis results of sample OVA 6 and their chart - graphical representation.

OVA 7

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comments 1	data	*OVA 7*
6 (< 0.062 mm)	5	20.0	20.00	100.00	Md (median)	1.00		ϕ5	0
5 (0.062 mm)	4	44.84	45.00	80.00	M (mean)	2.55		ϕ16	0.15
4 (0.125 mm)	3	7.77	8.00	35.00	Sorting	1.74	Poorly sorted	ϕ50	3.3
3 (0.25 mm)	2	7.7	7.00	27.00	Skewness	-8.88	Very coarse skew	ϕ84	4.2
2 (0.5 mm)	1	4.2	5.00	20.00				ϕ95	4.8
1 (1 mm)	0	15.25	15.00	15.00					
TOTALS		99.76	100.00						

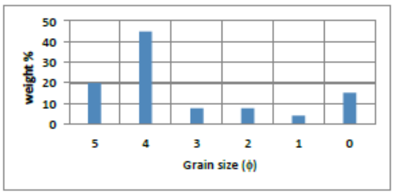

Figure 8: Sieve analysis results of sample OVA 7 and their chart - graphical representation.

OVA 8

Sieve No	(ϕ)	weight %	%	Cum %
6 (< 0.062 mm)	5	14.68	15.00	100.00
5 (0.062 mm)	4	43.85	45.00	85.00
4 (0.125 mm)	3	9.74	10.00	40.00
3 (0.25 mm)	2	14.3	15.00	30.00
2 (0.5 mm)	1	11.0	10.00	15.00
1 (1 mm)	0	4.24	5.00	5.00
TOTALS		97.81	100.00	

Statistics		Comment 1
Md (median)	2.00	
M (mean)	2.70	
Sortinga	1.40	Poorly sorted
Skewness	-5.28	Very coarse skew

data	*OVA 8*
ϕ_5	0
ϕ_{16}	1.1
ϕ_{50}	3.1
ϕ_{84}	3.9
ϕ_{95}	4.65

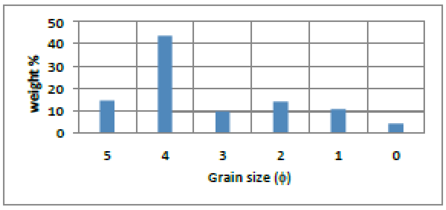

Figure 9: Sieve analysis results of sample OVA 8 and their chart - graphical representation.

OVA 9

Sieve No	(ϕ)	Weight %	%	Cum %
8(< 0.062 mm)	5	20.43	20.00	100.00
7 (0.062 mm)	4	20.15	20.00	80.00
6 (0.125 mm)	3	3.20	3.00	60.00
5 (0.25 mm)	2	2.00	2.00	57.00
4 (0.5 mm)	1	10.00	10.00	55.00
3(1 mm)	0	10.15	5.00	45.00
2(< 4mm)	-1	15.22	15.00	40
1(≥8mm)	-3	24.75	25.00	25
TOTALS		94.9	100.00	

Statistics		Comment 1
Md (median)	2.40	
M (mean)	1.53	
Sorting	1.74	Poorly sorted
Skewness	15.05	very coarse skew

data	*OVA 9*
$(\phi)_5$	0
$(\phi)_{16}$	0
$(\phi)_{50}$	0.5
$(\phi)_{84}$	4.1
$(\phi)_{95}$	4.7

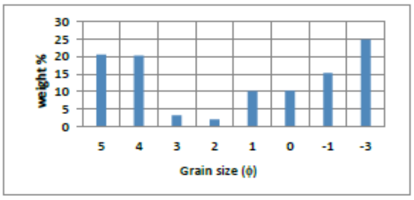

Figure 10: Sieve analysis results of sample OVA 9 and their chart - graphical representation.

OVA 10

Sieve No	(ϕ)	Weight %	%	Cum %
6 (< 0.062 mm)	5	24.6	25.00	100.00
5 (0.062 mm)	4	59.52	60.00	75.00
4 (0.125 mm)	3	2.30	2.00	15.00
3 (0.25 mm)	2	4.97	5.00	13.00
2 (0.5 mm)	1	4.17	4.00	8.00
1 (1 mm)	0	4.18	4.00	4.00
TOTALS		99.74	100.00	

Statistics		Comment 1
Md (median)	1.80	
M (mean)	3.63	
Sorting	1.02	Poorly sorted
Skewness	-5.46	very coarse skew

data	*OVA 10*
$(\phi)_5$	0.1
$(\phi)_{16}$	3
$(\phi)_{50}$	3.6
$(\phi)_{84}$	4.3
$(\phi)_{95}$	4.7

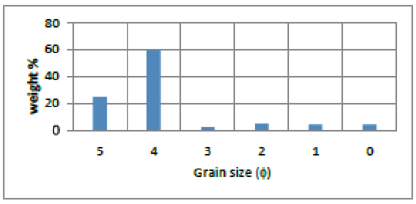

Figure 11: Sieve analysis results of sample OVA 10 and their chart - graphical representation.

OVA 11

Sieve No	(ϕ)	Weight %	%	Cum %
6 (< 0.062 mm)	5	9.97	10.00	100.00
5 (0.062 mm)	4	29.9	30.00	90.00
4 (0.125 mm)	3	15.2	15.00	60.00
3 (0.25 mm)	2	15.6	15.00	45.00
2 (0.5 mm)	1	14.7	15.00	30.00
1 (1 mm)	0	14.4	15.00	15.00
TOTALS		99.77	100.00	

Statistics		Comment 1
Md (median)	1.40	
M (mean)	1.97	
Sorting	1.45	Poorly sorted
Skewness	-3.49	Very coarse skew

data	*OVA 11*
ϕ5	0
ϕ16	0.1
ϕ50	2.4
ϕ84	3.4
ϕ95	4.15

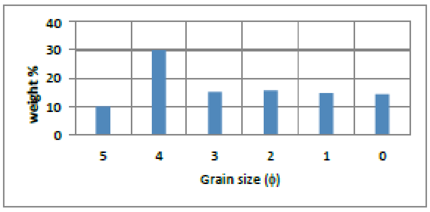

Figure 12: Sieve analysis results of sample OVA 11 and their chart - graphical representation.

OVA 12

Sieve No	(ϕ)	Weight%	%	Cum %
8(< 0.062 mm)	5	12.6	13.0	100.00
7(0.062 mm)	4	39.8	40.00	87.00
6 (0.125 mm)	3	10.2	10.00	47.00
5 (0.25 mm)	2	11.4	12.00	37.00
4 (0.5 mm)	1	9.3	10.00	25.00
3 (1 mm)	0	3.0	3.00	15.00
2(4mm)	-1	9.1	10.00	12.00
1(>8mm)	-3	2.0	2.00	2.00
TOTALS		97.4		

Statistics		Comment 1
Md (median)	2.40	
M (mean)	2.37	
Sorting	2.12	Poorly sorted
Skewness	-23.82	Very coarse skew

data	*OVA 12*
ϕ5	-3.3
ϕ16	0.1
ϕ50	3.1
ϕ84	3.9
ϕ95	4.4

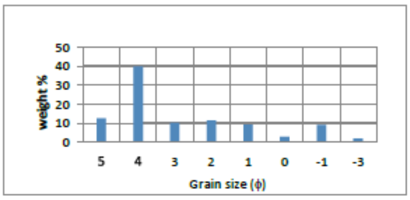

Figure 13: Sieve analysis results of sample OVA 12 and their chart - graphical representation.

OVA 13

Sieve No	(ϕ)	Weight %	%	Cum %
6 (< 0.062 mm)	5	19.5	20.00	95.00
5 (0.062 mm)	4	28.92	30.00	75.00
4 (0.125 mm)	3	9.43	10.00	45.00
3 (0.25 mm)	2	9.37	10.00	35.00
2 (0.5 mm)	1	15.4	15.00	25.00
1 (1 mm)	0	15.3	15.00	15.00
TOTALS		97.92	100.00	

Statistics		Comments 1
Md (median)	1.70	
M (mean)	2.43	
Sorting	1.74	Poorly sorted
Skewness	-6.54	Very coarse skew

data	*OVA 13*
ϕ5	0
ϕ16	0.1
ϕ50	3
ϕ84	4.2
ϕ95	4.7

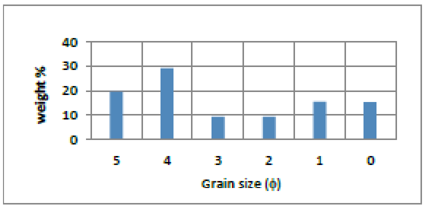

Figure 14: Sieve analysis results of sample OVA 13 and their chart - graphical representation.

OVA 14

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comments 1	data	OVA 14
6 (< 0.062 mm)	5	30.11	30.00	100.00	Md (median)	2.30		ϕ5	0
5 (0.062 mm)	4	34.6	35.00	70.00	M (mean)	2.73		ϕ16	0.4
4 (0.125 mm)	3	5.1	5.00	35.00	sorting	1.65	Poorly sorted	ϕ50	3.4
3 (0.25 mm)	2	4.91	5.00	30.00	Skewness	-9.38	Very coarse skew	ϕ84	4.4
2 (0.5 mm)	1	14.6	15.00	25.00				ϕ95	4.3
1 (1 mm)	0	10.2	10.00	10.00					
TOTALS		99.52	100.00						

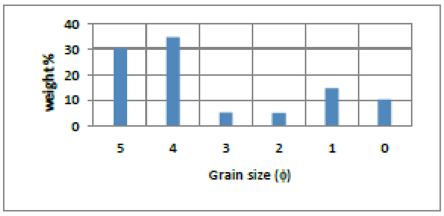

Figure 15: Sieve analysis results of sample OVA 14 and their chart - graphical representation.

OVA 15

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	OVA 15
6 (< 0.062 mm)	5	34.27	34.00	100.00	Md (median)	2.30		ϕ5	0
5 (0.062 mm)	4	30.1	30.00	66.00	M (mean)	2.93		ϕ16	1.2
4 (0.125 mm)	3	4.50	5.00	36.00	Sorting	1.45	Poorly sorted	ϕ50	3.5
3 (0.25 mm)	2	19.1	20.00	31.00	Skewness	-7.75	Very coarse skew	ϕ84	4.1
2 (0.5 mm)	1	4.90	5.00	11.00				ϕ95	4.8
1 (1 mm)	0	6.20	6.00	6.00					
TOTALS		99.07	100.00						

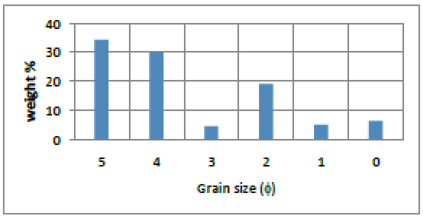

Figure 16: Sieve analysis results of sample OVA 15 and their chart - graphical representation.

6. Melendiz sediments analysis

MEL 1

Sieve No	(ϕ)	Weight %	%	Cum %	statistics		Comment 1	data	MEL 1
6 (< 0.062 mm)	5	24.13	25.00	100.00	Md (median)	0.90		ϕ5	1
5 (0.062 mm)	4	54.41	55.00	75.00	M (mean)	3.30		ϕ16	2.4
4 (0.125 mm)	3	8.6	8.00	20.00	Sorting	1.08	Poorly sorted	ϕ50	3.1
3 (0.25 mm)	2	6.8	7.00	12.00	Skewness	-0.16	Coarse skew	ϕ84	4.4
2 (0.5 mm)	1	3.2	3.00	5.00				ϕ95	4.8
1 (1 mm)	0	2.3	2.00	2.00					
TOTALS		99.44	100.00						

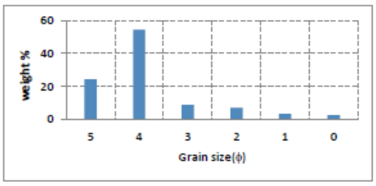

Figure 17: Sieve analysis results of sample MEL 1 and their chart-graphical representation.

MEL 2

Sieve No	(ϕ)	Weight %	%	Cum %
7 (< 0.062 mm)	5	28	28.00	100.00
6 (0.062 mm)	4	44.45	45.00	72.00
5 (0.125 mm)	3	4.95	5.00	27.00
4 (0.25 mm)	2	9.7	10.00	22.00
3 (0.5 mm)	1	5.45	5.00	12.00
2 (1 mm)	0	4.85	5.00	7.00
1(< 4mm)	-1	2.00	2.00	2.00
TOTALS		99.4	100.00	

Statistics		Comments 1
Md (median)	1.50	
M (mean)	3.10	
Sorting	1.49	Poorly sorted
Skewness	-7.43	Very coarse skew

data	MEL 2
ϕ5	-0.1
ϕ16	1.4
ϕ50	3.5
ϕ84	4.41
ϕ95	4.8

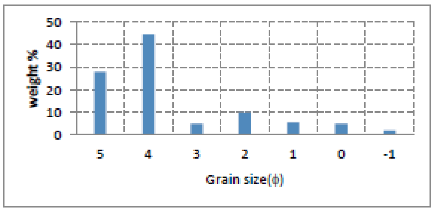

Figure 18: Sieve analysis results of sample MEL 2 and their chart-graphical representation.

MEL 3

Sieve No	(ϕ)	Weight %	%	Cum %
8 (< 0.062 mm)	5	31.71	30.00	100.00
7 (0.062 mm)	4	38.53	40.00	70.00
6 (0.125 mm)	3	3.17	3.00	30.00
5 (0.25 mm)	2	4.95	5.00	27.00
4 (0.5 mm)	1	4.37	5.00	22.00
3 (1 mm)	0	9.75	10.00	17.00
2(< 4mm)	-1	5.00	5.00	7.00
1(8mm)	-2	2.00	2.00	2.00
TOTALS		99.48	100.00	

Statistics		Comment 1
Md (median)	2.40	
M (mean)	1.90	
Sorting	2.67	Very poorly sorted
Skewness	-25.96	Very coarse skew

data	MEL 3
ϕ5	-2.6
ϕ16	-1.8
ϕ50	3.1
ϕ84	4.4
ϕ95	4.8

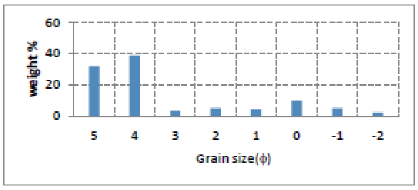

Figure 19: Sieve analysis results of sample MEL 3 and their chart-graphical representation.

MEL 4

Sieve No	(ϕ)	Weight %	%	Cum %
7 (< 0.062 mm)	5	25.71	25.00	100.00
6 (0.062 mm)	4	24.53	25.00	75.00
5 (0.125 mm)	3	12.17	12.00	50.00
4 (0.25 mm)	2	7.95	8.00	38.00
3 (0.5 mm)	1	9.37	10.00	30.00
2(1 mm)	0	11.75	10.00	20.00
1(< 4mm)	-1	10.00	10.00	10.00
TOTALS		101.48	100.00	

Statistics		Comment 1
Md (median)	2.40	
M (mean)	1.93	
Sorting	2.21	Very poorly sorted
Skewness	-12.66	Very coarse skew

data	MEL 4
ϕ5	0
ϕ16	-1.6
ϕ50	3.0
ϕ84	4.4
ϕ95	4.7

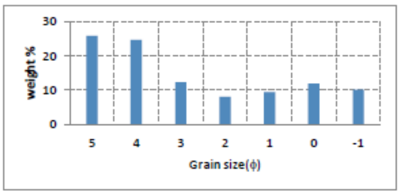

Figure 20: Sieve analysis results of sample MEL 4 and their chart-graphical representation.

MEL 5

Sieve No	(ϕ)	Weight %	%	Cum %
7(< 0.062 mm)	5	10.1	10.00	100.00
6 (0.062 mm)	4	10	10.00	90.00
5 (0.125 mm)	3	2.66	2.00	80.00
4 (0.25 mm)	2	2.4	2.00	78.00
3 (0.5 mm)	1	2.95	3.00	76.00
2 (1 mm)	0	3.18	3.00	73.00
1(< 4mm)	-1	10	10.00	70.00
1(8mm)	-2	60.2	60.00	60.00
TOTALS		101.49	100.00	

Statistics		Comment 1	data	*MEL 5*
Md (median)	1.60		ϕ5	-2
M (mean)	-0.20		ϕ16	-2
Sorting	2.27	Very poorly sorted	ϕ50	-2
Skewness	33.19	Very fine skew	ϕ84	3.4
			ϕ95	4.1

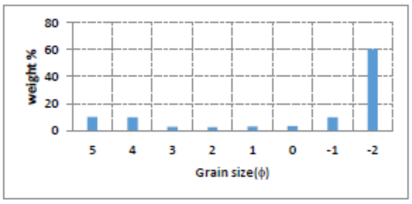

Figure 21: Sieve analysis results of sample MEL 5 and their chart-graphical representation.

MEL 6

Sieve No	(ϕ)	Weight %	%	Cum %
8 (< 0.062 mm)	5	14.55	15.00	100.00
7 (0.062 mm)	4	19.7	20.00	85.00
6 (0.125 mm)	3	14.6	5.00	65.00
5 (0.25 mm)	2	13.8	15.00	60.00
4 (0.5 mm)	1	5.00	5.00	45.00
3 (1 mm)	0	4.60	5.00	40.00
2(< 4mm)	-1	23.0	25.00	35.00
1(8mm)	-3	9.32	10.00	10.00
TOTALS		104.57	100.00	

Statistics		Comment 1	data	*MEL 6*
Md (median)	1.60		ϕ5	-3
M (mean)	0.43		ϕ16	-3.8
Sorting	3.09	Very poorly sorted	ϕ50	1.15
Skewness	-10.99	Very coarse skew	ϕ84	3.95
			ϕ95	4.6

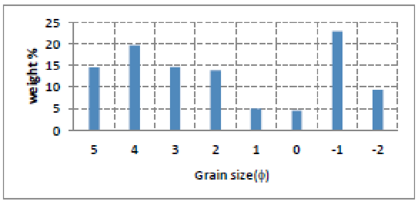

Figure 22: Sieve analysis results of sample MEL 6 and their chart-graphical representation.

MEL 7

Sieve No	(ϕ)	Weight %	%	Cum %
7(< 0.062 mm)	5	10.5	10.00	100.00
6(0.062 mm)	4	24.84	25.00	90.00
5 (0.125 mm)	3	9.77	10.00	65.00
4 (0.25 mm)	2	18.7	20.00	55.00
3 (0.5 mm)	1	20.2	20.00	35.00
2(1 mm)	0	9.55	10.00	15.00
1(< 4mm)	-1	5.00	5.00	5.00
TOTALS		98.26	100.00	

Statistics		Comment 1	data	*MEL 7*
Md (median)	1.00		ϕ5	-1
M (mean)	1.90		ϕ16	0.1
Sorting	1.81	Poorly sorted	ϕ50	1.7
Skewness	2.00	Very fine skew	ϕ84	3.9
			ϕ95	4.7

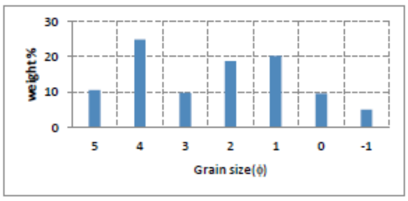

Figure 23: Sieve analysis results of sample MEL 7 and their chart-graphical representation.

MEL 8

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*MEL 8*
8 (< 0.062 mm)	5	14.92	15.0	100.00	Md (median)	2.00		ϕ5	0.1
7(0.062 mm)	4	20.1	20.0	85.00	M (mean)	2.07		ϕ16	0.2
6 (0.125 mm)	3	5.00	5.0	65.00	Sorting	1.66	Poorly sorted	ϕ50	2
5(0.25 mm)	2	14.5	15.0	60.00	Skewness	2.50	Very fine skew	ϕ84	4
4 (0.5 mm)	1	4.80	5.0	45.00				ϕ95	4.8
3 (1 mm)	0	5.00	5.0	40.00					
2(< 4mm)	-1	24.8	25.0	35.00					
1(8mm)	-3	10.2	10.0	10.00					
TOTALS		99.32	100.00						

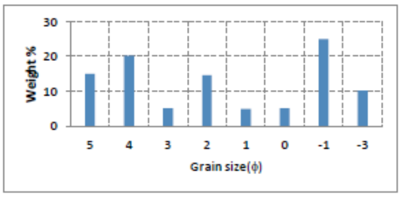

Figure 24: Sieve analysis results of sample MEL 8 and their chart-graphical representation.

MEL 9

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*MEL 9*
6 (< 0.062 mm)	5	20.43	20.00	100.00	Md (median)	2.40		ϕ5	1
5 (0.062 mm)	4	60.15	60.00	80.00	M (mean)	2.88		ϕ16	1.25
4 (0.125 mm)	3	8.2	8.00	20.00	Sorting	1.31	Poorly sorted	ϕ50	3.2
3 (0.25 mm)	2	7.1	7.00	12.00	Skewness	-2.62	Very coarse skew	ϕ84	4.2
2 (0.5 mm)	1	3.0	3.00	5.00				ϕ95	4.75
1 (1 mm)	0	2.15	2.00	2.00					
TOTALS		101.03	100.00						

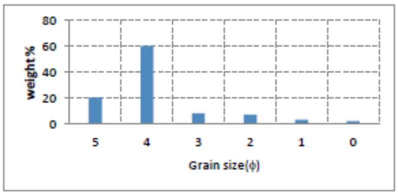

Figure 25: Sieve analysis results of sample MEL 9 and their chart-graphical representation.

MEL 10

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*MEL 10*
6 (< 0.062 mm)	5	19.16	20.00	100.00	Md (median)	1.80		ϕ5	0
5 (0.062 mm)	4	54.32	55.00	80.00	M (mean)	3.25		ϕ16	2.1
4 (0.125 mm)	3	10.3	10.00	25.00	Sorting	1.22	Poorly sorted	ϕ50	3.44
3 (0.25 mm)	2	4.67	5.00	15.00	Skewness	-5.85	Very coarse skew	ϕ84	4.2
2 (0.5 mm)	1	5.17	5.00	10.00				ϕ95	4.6
1 (1 mm)	0	4.87	5.00	5.00					
TOTALS		98.49	100.00						

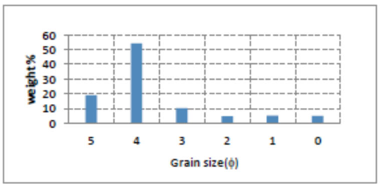

Figure 26: Sieve analysis results of sample MEL 10 and their chart-graphical representation.

7. Imamhatip sediments analysis

IMA 1

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	IMA 1
6 (<0.062 mm)	5	15.13	15.00	100.00	Md (median)	0.90		ϕ5	0
5 (0.062 mm)	4	34.11	35.00	85.00	M (mean)	2.67		ϕ16	1.1
4 (0.125 mm)	3	10.6	10.00	50.00	Sorting	1.41	Poorly sorted	ϕ50	3
3 (0.25 mm)	2	24.8	25.00	40.00	Skewness	-4.46	Very coarse skew	ϕ84	3.9
2 (0.5 mm)	1	11.0	10.00	15.00				ϕ95	4.7
1 (1 mm)	0	5.3	5.00	5.00					
TOTALS		100.94	100.00						

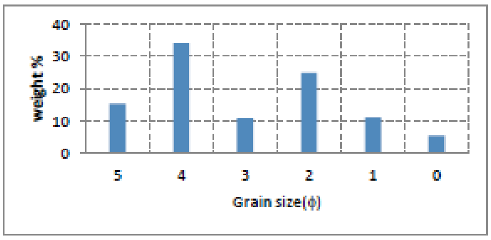

Figure 27: Sieve analysis results of sample IMA 1 and their chart-graphical representation.

IMA 2

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	IMA 2
6 (< 0.062 mm)	5	16.4	16.00	100.00	Md (median)	1.50		ϕ5	0
5 (0.062 mm)	4	34.45	34.00	84.00	M (mean)	2.53		ϕ16	0.6
4 (0.125 mm)	3	14.95	15.00	50.00	Sorting	1.56	Poorly sorted	ϕ50	3.0
3 (0.25 mm)	2	16.7	17.00	35.00	Skewness	-5.44	Very coarse skew	ϕ84	4.0
2 (0.5 mm)	1	7.45	8.00	18.00				ϕ95	4.7
1 (1 mm)	0	10.85	10.00	10.00					
TOTALS		100.8	100.00						

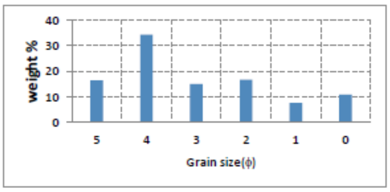

Figure 28: Sieve analysis results of sample IMA 2 and their chart-graphical representation.

IMA 3

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	IMA 3
7(< 0.062 mm)	5	29.71	30.00	100.00	Md (median)	2.40		ϕ5	-0.1
6 (0.062 mm)	4	34.53	35.00	70.00	M (mean)	2.33		ϕ16	0.1
5 (0.125 mm)	3	8.17	8.00	35.00	Sorting	1.84	Poorly sorted	ϕ50	2.4
4(0.25 mm)	2	6.95	7.00	27.00	Skewness	-0.69	Very coarse skew	ϕ84	4.5
3(0.5 mm)	1	10.37	10.00	20.00				ϕ95	4.8
2 (1 mm)	0	5.75	5.00	10.00					
1(<4mm)	-1	5.00	5.00	5.00					
TOTALS		100.48	100.00						

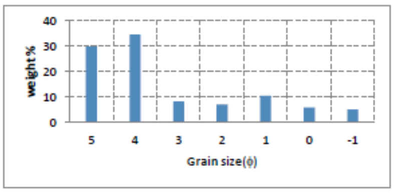

Figure 29: Sieve analysis results of sample IMA 3 and their chart-graphical representation.

IMA 4

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	IMA 4
8(< 0.062 mm)	5	29.71	30.00	100.00	Md (median)	2.40		ϕ5	-0.1
7(0.062 mm)	4	20.53	20.00	70.00	M (mean)	2.33		ϕ16	0.1
6 (0.125 mm)	3	7.17	7.00	50.00	Sorting	1.84	Poorly sorted	ϕ50	2.4
5(0.25 mm)	2	7.95	8.00	43.00	Skewness	-0.69	Very coarse skew	ϕ84	4.5
4 (0.5 mm)	1	5.37	5.00	35.00				ϕ95	4.8
3(1 mm)	0	9.75	10.00	30.00					
2(<4mm)	-1	10.2	10.00	20.00					
1(>8mm)	-3	10	10.00	10.00					
TOTALS		100.68	100.00						

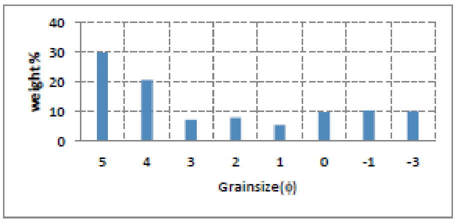

Figure 30: Sieve analysis results of sample IMA 4 and their chart-graphical representation.

IMA 5

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	IMA 5
6 (< 0.062 mm)	5	30.16	30.00	93.00	Md (median)	1.60		ϕ5	-1.3
5 (0.062 mm)	4	23	23.00	63.00	M (mean)	1.80		ϕ16	-0.5
4 (0.125 mm)	3	9.6	10.00	40.00	Sorting	2.09	Poorly sorted	ϕ50	1.6
3 (0.25 mm)	2	10.4	10.00	30.00	Skewness	1.74	Very fine skew	ϕ84	4.3
2 (0.5 mm)	1	4.95	5.00	20.00				ϕ95	4.6
1 (1 mm)	0	15.18	15.00	15.00					
2(<4mm)	-1	5.00	5.00	7.00					
1(>8mm)	-2	2.00	2.00	2.00					
TOTALS		100.29	100.00						

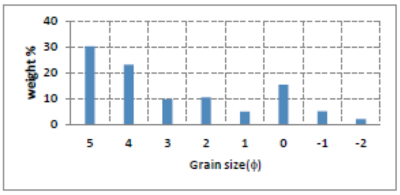

Figure 31: Sieve analysis results of sample IMA 5 and their chart-graphical representation.

IMA 6

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	IMA 6
7(< 0.062 mm)	5	19.5	20.00	100.00	Md (median)	1.60		ϕ5	-0.4
6 (0.062 mm)	4	33.17	33.00	80.00	M (mean)	1.63		ϕ16	0.1
5(0.125 mm)	3	14.88	15.00	47.00	Sorting	1.53	Poorly sorted	ϕ50	1.6
4(0.25 mm)	2	9.80	10.00	32.00	Skewness	2.66	Very fine skew	ϕ84	3.2
3(0.5 mm)	1	10.00	10.00	22.00				ϕ95	4.6
2(1 mm)	0	10.6	10.00	12.00					
1(>8mm)	-3	2.00	2.00	2.00					
TOTALS		99.95	100.00						

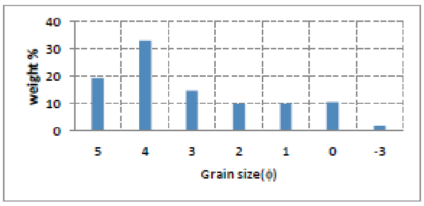

Figure 32: Sieve analysis results of sample IMA 6 and their chart-graphical representation.

IMA 7

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	IMA 7
					Md (median)	1.00		ϕ5	-0.4
7(< 0.062 mm)	5	19.5	20.00	100.00	M (mean)	1.10		ϕ16	-0.2
6(0.062 mm)	4	39.84	40.00	80.00	Sorting	1.28	Poorly sorted	ϕ50	1
5 (0.125 mm)	3	17.77	18.00	40.00	Skewness	2.81	Very fine skew	ϕ84	2.5
4 (0.25 mm)	2	5.20	5.00	22.00				ϕ95	3.6
3 (0.5 mm)	1	5.20	5.00	17.00					
2(1 mm)	0	10.25	10.00	12.00					
1(>8mm)	-3	2.00	2.00	2.00					
TOTALS		99.76	100.00						

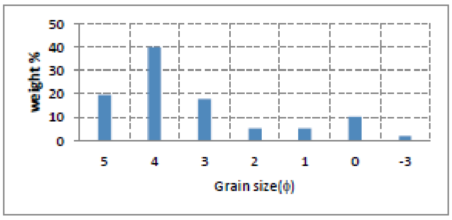

Figure 33: Sieve analysis results of sample IMA 7 and their chart-graphical representation.

IMA 8

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	IMA 8
6 (< 0.062 mm)	5	19.68	20.00	100.00	Md (median)	2.00		ϕ5	0
5 (0.062 mm)	4	59.35	60.00	80.00	M (mean)	3.27		ϕ16	2.1
4 (0.125 mm)	3	4.74	5.00	20.00	Sorting	1.24	Poorly sorted	ϕ50	3.5
3 (0.25 mm)	2	5.30	5.00	15.00	Skewness	-6.08	Very coarse skew	ϕ84	4.2
2 (0.5 mm)	1	5.21	5.00	10.00				ϕ95	4.75
1 (1 mm)	0	5.24	5.00	5.00					
TOTALS		99.52	100.00						

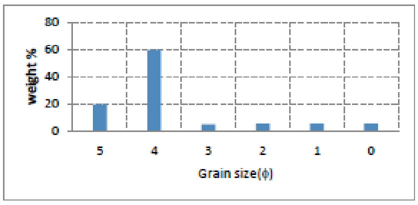

Figure 34: Sieve analysis results of sample IMA 8 and their chart-graphical representation.

IMA 9

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	IMA 9
7(< 0.062 mm)	5	25.43	25.00	100.00	Md (median)	2.40		ϕ5	-0.5
6(0.062 mm)	4	30.15	30.00	75.00	M (mean)	2.10		ϕ16	0.1
5(0.125 mm)	3	17.20	17.00	45.00	Sorting	1.73	Poorly sorted	ϕ50	2.4
4 (0.25 mm)	2	11.00	10.00	28.00	Skewness	-2.99	Very coarse skew	ϕ84	3.8
3 (0.5 mm)	1	3.31	3.00	18.00				ϕ95	4.8
2(1 mm)	0	10.15	10.00	15.00					
1(>8mm)	-3	5.00	5.00	5.00					
TOTALS		102.24	100.00						

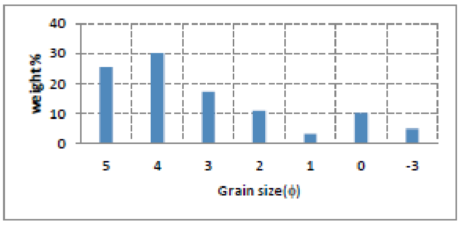

Figure 35: Sieve analysis results of sample IMA 9 and their chart-graphical representation.

IMA 10

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*IMA 10*
8(< 0.062 mm)	5	19.86	20.00	100.00	Md (median)	1.80		ϕ5	-0.8
7 (0.062 mm)	4	29.32	30.00	80.00	M (mean)	1.93		ϕ16	-0.4
6(0.125 mm)	3	6.3	6.00	50.00	Sorting	2.05	Poorly sorted	ϕ50	1.8
5 (0.25 mm)	2	19.67	20.00	44.00	skewness	2.08	Very fine skew	ϕ84	4.4
4 (0.5 mm)	1	11.17	10.00	24.00				ϕ95	4.8
3 (1 mm)	0	9.58	10.00	14.00					
2(<4mm)	-2	2.00	2.00	4					
1(>8mm)	-3	2.00	2.00	2					
TOTALS		99.9	100.00						

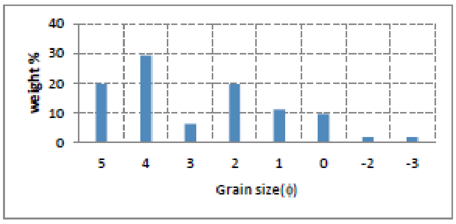

Figure 36: Sieve analysis results of sample IMA 10 and their chart-graphical representation.

IMA 11

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*IMA 11*
7(< 0.062 mm)	5	14.9	15.00	100.00	Md (median)	1.40		ϕ5	-0.1
6 (0.062 mm)	4	44.9	45.00	85.00	M (mean)	1.63		ϕ16	0.1
5 (0.125 mm)	3	10.2	10.00	40.00	Sorting	1.55	Poorly sorted	ϕ50	1.4
4(0.25 mm)	2	10.6	10.00	30.00	skewness	5.48	Very fine skew	ϕ84	3.4
3(0.5 mm)	1	10.7	10.00	20.00				ϕ95	4.7
2(1 mm)	0	2.70	3.00	10.00					
1(<4mm)	-1	7.00	7.00	7.00					
TOTALS		101							

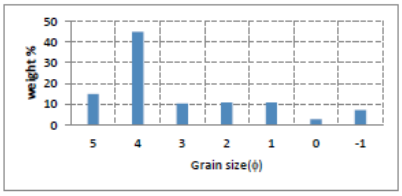

Figure 37: Sieve analysis results of sample IMA 11 and their chart-graphical representation.

IMA 12

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*IMA 12*
6 (< 0.062 mm)	5	50.16	50.00	100.00	Md (median)	2.40		ϕ5	0
5 (0.062 mm)	4	34.8	35.00	50.00	M (mean)	3.93		ϕ16	3.1
4 (0.125 mm)	3	2.2	2.00	15.00	Sorting	1.14	Poorly sorted	ϕ50	4
3 (0.25 mm)	2	3.4	3.00	13.00	Skewness	-7.76	Very coarse skew	ϕ84	4.7
2 (0.5 mm)	1	5.3	5.00	10.00				ϕ95	4.9
1 (1 mm)	0	5	5.00	5.00					
TOTALS		100.86	100.00						

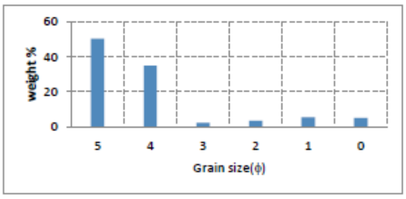

Figure 38: Sieve analysis results of sample IMA 12 and their chart-graphical representation.

IMA 13

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*IMA 13*
6 (< 0.062 mm)	5	19.95	20.00	100.00	Md (median)	1.70		ϕ5	1
5 (0.062 mm)	4	70.2	70.00	80.00	M (mean)	3.63		ϕ16	3.1
4 (0.125 mm)	3	2.3	2.00	10.00	Sorting	0.84	Poorly sorted	ϕ50	3.6
3 (0.25 mm)	2	2.9	3.00	8.00	Skewness	-2.66	Very coarse skew	ϕ84	4.2
2 (0.5 mm)	1	2.4	2.00	5.00				ϕ95	4.75
1 (1 mm)	0	3.1	3.00	3.00					
TOTALS		100.85	100.00						

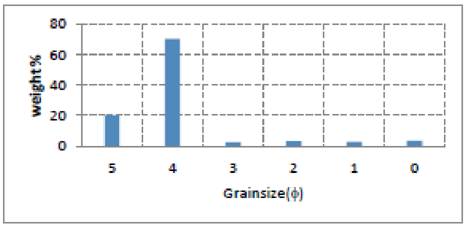

Figure 39: Sieve analysis results of sample IMA 13 and their chart-graphical representation.

IMA 14

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*IMA 14*
6 (< 0.062 mm)	5	29.57	30.00	100.00	Md (median)	2.30		ϕ5	0
5 (0.062 mm)	4	40.4	40.00	70.00	M (mean)	3.18		ϕ16	2.2
4 (0.125 mm)	3	15.1	15.00	30.00	Sorting	1.14	Poorly sorted	ϕ50	3.45
3 (0.25 mm)	2	4.91	5.00	15.00	Skewness	-5.85	Very coarse skew	ϕ84	3.9
2 (0.5 mm)	1	5.4	5.00	10.00				ϕ95	4.7
1 (1 mm)	0	5.2	5.00	5.00					
TOTALS		100.58	100.00						

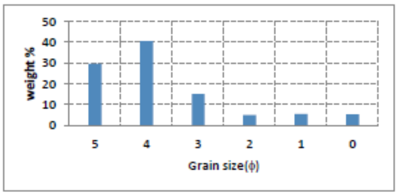

Figure 40: Sieve analysis results of sample IMA 14 and their chart-graphical representation.

IMA 15

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*IMA 15*
6 (< 0.062 mm)	5	20.38	20.00	100.00	Md (median)	1.90		ϕ5	0
5 (0.062 mm)	4	59.6	60.00	80.00	M (mean)	3.18		ϕ16	2.2
4 (0.125 mm)	3	5.1	5.00	20.00	Sorting	1.14	Poorly sorted	ϕ50	3.45
3 (0.25 mm)	2	4.5	5.00	15.00	Skewness	-5.85	Very coarse skew	ϕ84	3.9
2 (0.5 mm)	1	4.6	5.00	10.00				ϕ95	4.7
1 (1 mm)	0	5.38	5.00	5.00					
TOTALS		99.56	100.00						

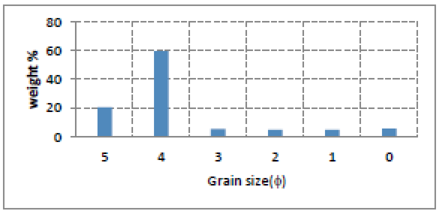

Figure 41: Sieve analysis results of sample IMA 15 and their chart-graphical representation.

IMA 16

Sieve No	(ϕ)	Weight %	%	Cum %	Statistics		Comment 1	data	*IMA 16*
6 (< 0.062 mm)	5	34.8	35.00	100.00	Md (median)	1.90		ϕ5	0.7
5 (0.062 mm)	4	49.6	50.00	65.00	M (mean)	3.62		ϕ16	3.1
4 (0.125 mm)	3	5.1	5.00	15.00	Sorting	0.86	Poorly sorted	ϕ50	3.7
3 (0.25 mm)	2	4.2	4.00	10.00	Skewness	-4.00	Very coarse skew	ϕ84	4.05
2 (0.5 mm)	1	4.6	4.00	6.00				ϕ95	4.81
1 (1 mm)	0	2.13	2.00	2.00					
TOTALS		**100.43**	**100.00**						

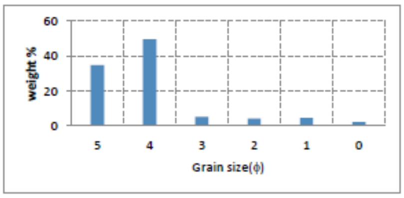

Figure 42: Sieve analysis results of sample IMA 16 and their chart-graphical representation.

8. Dıscussıon and conclusıons

9. Particle Size Analysis

The sample belonging to the Ovalıbağ, Melendiz and İmamhatip regions, which can represent the sediments in the Çiftlik plain, was selected by pre-examination. According to these researches, 1) there are common gravel and coarse sand in the profiles on the alluvial fan, the coarse silt and clay amounts are quite low, that is, it does not exceed 20%, 2) on the lake shore and its immediate surroundings, it covers especially Ovalıbağ and İmamhatip localities and includes a wide variety of lithological conditions in the region. The presence of unconsolidated sediments and the differences in their transport mechanisms (lake and terrestrial grain inputs) prove. Sand and gravel levels show poor sorting since they are little processed on the lake shore or by the stream. On the other hand, trapezoidal values are generally in the form of strong rough-keystone. These values can be positive or negative. The reason for this is because it is stream, delta and lake sediment and is constantly fed with clastic material. The rapid change of some levels in the profiles can only be explained by climate changes. Briefly, this lowland lake is fed by delta and alluvial fans, streams, and lake shore and lake shore swamps. As a result of this research, it has been proven that the sedimentary material transported from the higher parts was carried by gravity, snow, water and wind and then stored without processing, 3) only fine-grained clay or silt or mud levels were detected in the center of the plain (Paleo-earthing levels increased in these parts).To shed light on today's warming temperatures, it is important to study the climate changes leading up to the Medieval Warm Period and the Little Ice Age[1].

The sedimentary grain size data parameters indicate that the sediments in the Çiftlik Basin could have been transported either by wind,glaciers and fluvial streams.

The distribution grain size suggest that these sediments were either unimodal,bimodal or polymodal in their distribution character and not uniform.This shows the multisource of the sediments.Cumulative changes undergone by sediment particles due to weathering,erosion,transport till its final deposition as sediments is known as maturity of sediments.Well sorted grains exhibit high textural maturity while poorly sorted sediments exhibit low textural maturity.There is poor textural maturity in the Çiftlik basin because the sediments are poorly sorted and exhibit a range of grain size classes.

Similar results were found in Ereğli-Akgöl and Bor regions[8]. According to the grain size analyzes carried out in Akgöl and Bor regions, it was determined that the unconsolidated sediments and paleosols that could represent some levels were poorly sorted. High $CaCO_3$ amounts have been determined in the region and according to this, profiles in the region contain high amounts of calcium carbonate and their amounts are in the order of 40-45%. Ereğli-Akgöl sediments were not affected by hydrothermal water inlets or hot waters may have been carried to the environment from afar, increasing the amount of $CaCO_3$. The Çiftlik plain does not contain $CaCO_3$ levels, because it is not possible for carbonate to enter the plain from anywhere.

As mentioned before, this plain is a very small plain with a diameter of 15 km and is surrounded by volcanic mountains. The connection of this plain includes only the Sileğin Gorge and a baogaz where Melendiz Stream flows into Ihlara Valley.

The grain size distribution in the Çiftlik plain has predominantly poorly and very poorly sorted grains due to low energy environment. The observed sorting variation is attributed to the velocity and difference in water turbulence of depositing currents.

This tells us that the grains originate in and around the plain. The standard deviation represents a lot of coarse skew since it is dependent on the size range of sediments.In the field,geologists use printed cards called comparators but in the laboratory,standard sieves are used.

Limitations to this research can be ascribed to the fact that it is only capable to determine particle sizes that range from 0.075mm to 100mm.

Therefore,some particles could not go through the sieves.Very fined particles (≤150um) can be less accurate using dry sieving.Subsequently,grain size analysis will be created in future with the availability of financial resources by using Master-sizer software for better results which simplifies the analysis by aiding selected optimal properties of the sediment grains with precise and robust measurements.

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