

# Exercise 9: SOIL ANALYSES

## Introduction

Soil analyses are an integral part of the work of a forensic geologist. Procedures for this laboratory are outlined below. The equipment needed for this purpose can be simple or complicated and will depend upon the availability in a given lab.

## SOIL TYPE

**Sands:** Soil that contains 85% to 90% or higher sand, with no more than 10% clay and with the rest silt.

**Loamy Sands:** Soil that contains between 70% to 85% sand and with clay being 14% or below.

**Sandy Loams:** Soil with 52% or more sand and 20% or less clay.

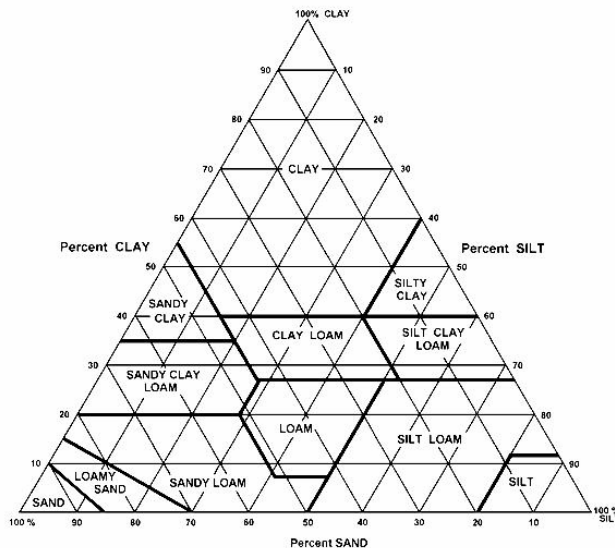
**Loam:** Soil with 7% to 27% clay, 28% to 50% silt, and less than 52% sand.

**Silt Loam:** Soil that contains 50% or more silt and 12% to 27% clay, or 50% to 80% silt and less than 12% clay.

**Clay Loam:** Soil that contains 27% to 40% clay and 20% to 45% sand.

**Clay:** Soil that contains 27% to 40% or more clay, and less than 45% sand and less than 40% silt.

**Additional types include:** Peaty, Chalky



Classification of Soils

## Procedures

Make notes on the following items as you proceed to examine the soil sample

1. Visually examine the soil sample describe it. What are he complements you can see.
2. Look at the sand under a binocular microscope and make notes
3. Weigh the sample
4. Clean half of the sample (note its weight) by using bleach to loosen the sticky material. Clean the sand and dry it in an oven at moderate temperature for it to dry.
5. Examine the dried sample and make notes on the proportion of different materials present. Omit the organics and work with the rest of the minerals present.

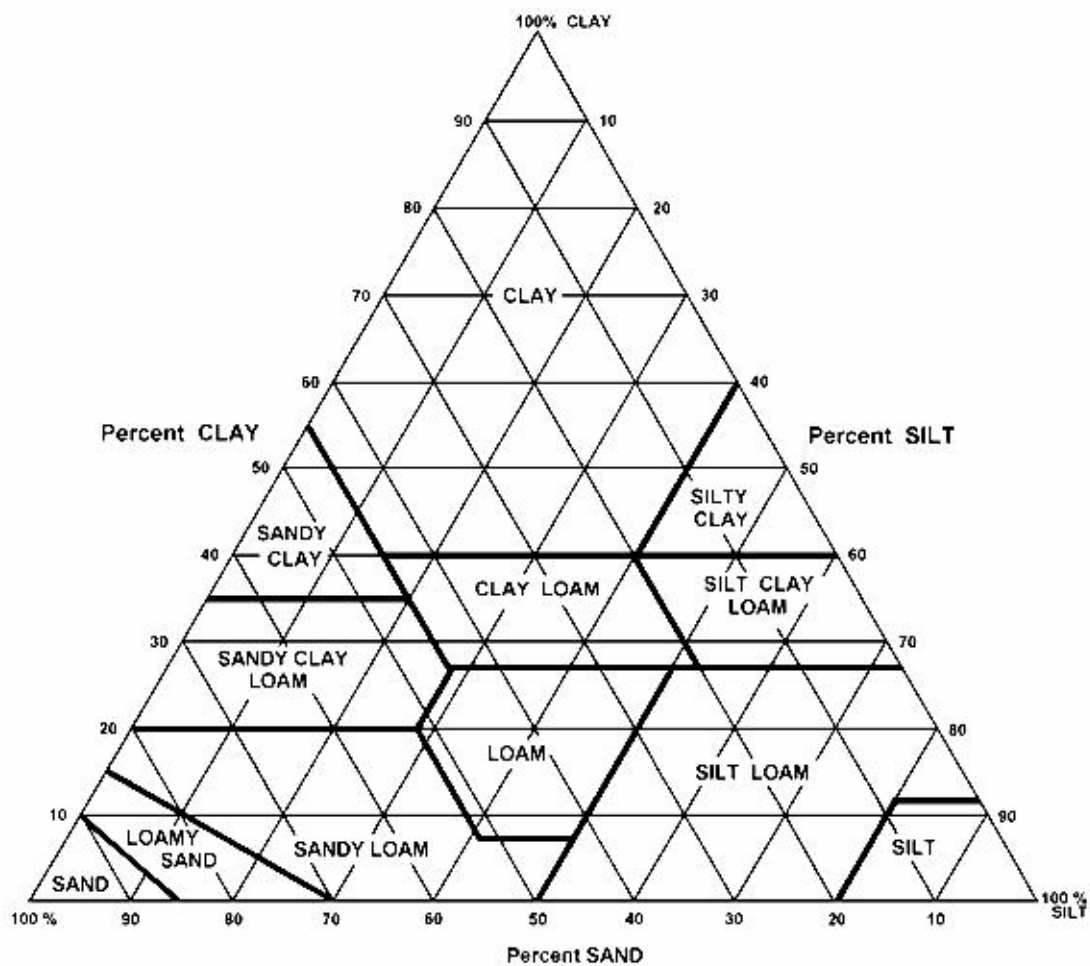
The amount of sand, silt, and clay ultimately makes up the class of the soil.

To determine the class type of an unknown soil we have to determine the ratio of sand, silt, and clay particles in a specific volume of soil. Soil particles are categorized into groups according to size.

**Clay** = less than 0.002 mm, **Silt** = 0.002 to 0.06 mm, and **Sand** = 0.06 to 2.0 mm, **Gravel** = greater than 2.0 mm.

To decide up on the ration, one can sieve the sample using available sieves and weighing the soil particles caught in different sieve sizes. [There are other methods of getting this information – flotation, centrifuging etc]

6. Classify the soil type. (see the write up on page 1 of this exercise)
7. Other things that could be done with the soil sample – depending on the availability of equipment.
  - a. Determining soil's organic matter in the soil using the ignition method
  - b. Characterization of minerals present in the soil sample – using polarizing microscope
  - c. Heavy mineral analyses of the soil – one may separate the material using heavy liquids, the isodynamic magnetic separator etc. This would help in identifying the provenance of the material.
  - d. Soil's bulk density
  - e. Soil's capillarity
  - f. Soil's water holding capacity
  - g. Soil pH



### Classification of Soils

## Standard Sieve Sizes

Mesh Size (microns)	TYLER	ASTM-E11	BS-410	DIN-4188
µm	Mesh	No.	Mesh	mm
5	2500		2500	0.005
10	1250		1250	0.010
15	800		800	0.015
20	625		625	0.020
22				0.022
25	500		500	0.025
28				0.028
32				0.032
36				0.036
38	400	400	400	
40				0.040
45	325	325	350	0.045
50				0.050
53	270	270	300	
56				0.056
63	250	230	240	0.063
71				0.071
75	200	200	200	
80				0.080
90	170	170	170	0.090
100				0.100
106	150	140	150	
112				0.112
125	115	120	120	0.125
140				0.140
150	100	100	100	
160				0.160
180	80	80	85	0.180
200				0.200
212	65	70	72	
250	60	60	60	0.250
280				0.280
300	48	50	52	
315				0.315
355	42	45	44	0.355
400				0.400
425	35	40	36	
450				0.450
500	32	35	30	0.500

560				0.560
600	28	30	25	
630				0.630
710	24	25	22	0.710
800				0.800
850	20	20	18	
900				0.900
1000	16	18	16	1.0
1120				1.12
1180	14	16	14	
1250				1.25
1400	12	14	12	1.4
1600				1.6
1700	10	12	10	
1800				1.8
2000	9	10	8	2.0
2240				2.24
2360	8	8	7	
2500				2.5
2800	7	7	6	2.8
3150				3.15
3350	6	6	5	
3550				3.55
4000	5	5	4	4.0
4500				4.5
4750	4	4	3.5	
5000				5.0