University of Mosul
College of Science

4th Year/Geology
Practical ore geology

Lab No.1 Monday 9/10/2017

Concentration Factor (C.F.)

The table below represents the average crustal abundance and the average minimum exploitable grade (cut-off grade) of several elements.

No.	Element Name	Symbol	Average Crustal Abundance wt%	average minimum exploitable grade wt%	Concentration Factor (C.F.)
1	Aluminium	Al	8	30	
2	Iron	Fe	5	25	
3	Copper	Cu	0.005	0.5	
4	Nickel	Ni	0.007	1.0	
5	Zinc	Zn	0.007	2.5	
6	Manganese	Mn	0.09	35	
7	Tin	Sn	0.0002	0.2	
8	Chromium	Cr	0.01	30	
9	Lead	Pb	0.001	2	
10	Gold	Au	0.0000004	0.0008	
11	Tungsten	W	0.0001	0.7	
12	Mercury	Hg	0.000008	0.2	

(1) Classify these elements geochemically as:
Abundant (A) Scarce (S)

(2) Calculate the concentration factor for each element knowing that

$$\text{C.F.} = \frac{\text{average crustal abundance}}{\text{average exploitable grade}}$$

(3) Using the given Log-Log paper, plot the relationship between concentration factor (Y-axis) and the average crustal abundance (x-axis).

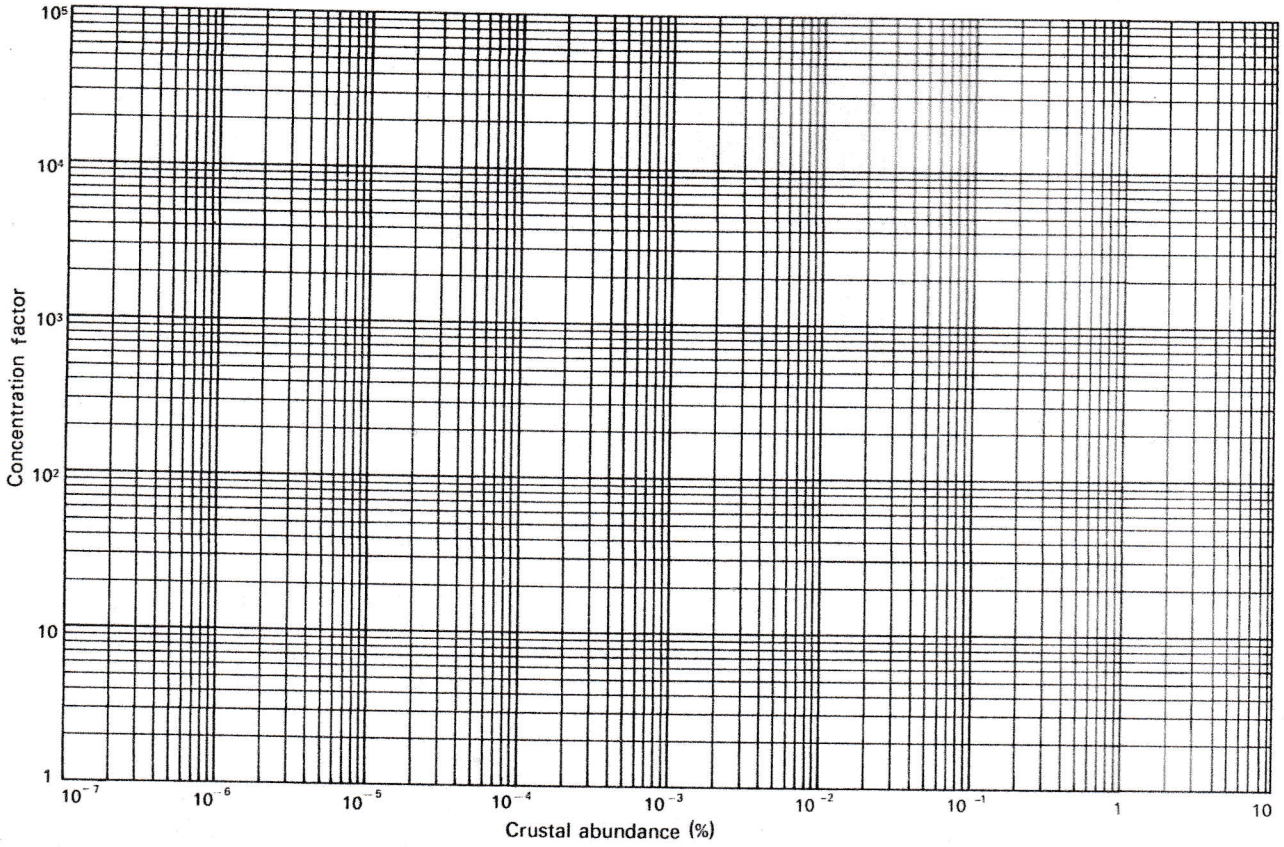
(4) What is the kind of this relationship (correlation)? Is it an inverse or direct correlation? Explain in detail.

(5) Are there any deviations from this general correlation? Give examples.

Concentration Factor: The number of times a metal has to be concentrated above its average crustal abundance to reach its cut-off grade.

Ore Grade: The percentage of concentration of the metal in its ore. It can be wt% or ppm.

Cut-off Grade: The lowest grade limit of the ore that can be economically exploited, and below this limit, the ore becomes less economic.


Concentration factor
10^5
10^4
10^3
10^2
10
1
10^{-7}
10^{-6}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
Crustal abundance (%)

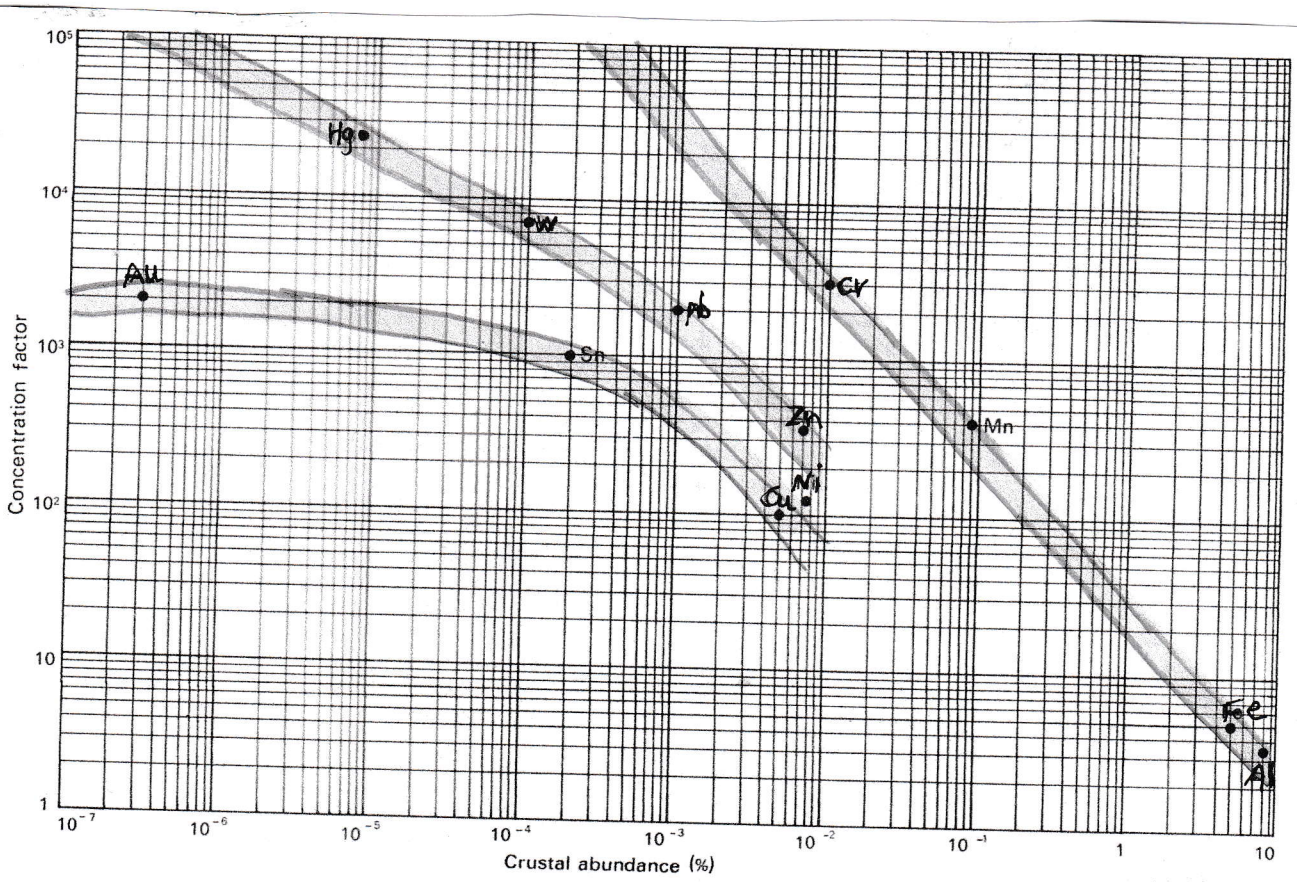
Lab

Solutions

(1) & (2)

Element	Classification	C.F.
Al	A	3.8
Fe	A	5
Cu	S	$1x10^2$
Ni	S	$1.4x10^2$
Zn	S	$3.6x10^2$
Mn	A	$3.9x10^2$
Sn	S	$1x10^3$
Cr	A	$3x10^3$
Pb	S	$2x10^3$
Au	S	$2x10^3$
W	S	$7x10^3$
Hg	S	$2.5x10^4$

(3) The plot



(3)

Lab 1

(4) * There is a general inverse correlation (the less abundant the element is the higher is its C.F.).

** There are three separate correlations within the general trend, involving:

(i) Al, Fe, Mn and Cr (abundant-element group)

(ii) Zn, Pb, W and Hg (scarce-element group)

(iii) Ni, Cu, Sn, and Au (very scarce element group)

(5) Yes there are, for examples:

1- Hg& AU

2- Cr &Ni

The reasons are factors lowering the cut-off grade including: price of element, properties of element, demand, technology etc.

Lab1