How do we check correctness of analyses?

Solute	Measured Conc (mg/L)
Ca^{2+}	92.0
Mg^{2+}	34.0
Na^{+}	8.2
K^{+}	1.4
Fe(III)	0.1
HCO_3^{-}	325.0
SO_4^{2-}	84.0
Cl^{-}	9.6
NO_3^{-}	13.0

1. Compare
Measured TDS and Calculated TDS

NOTE:
When calculating TDS we group the mass of some items and call it Alkalinity
Alkalinity = $[HCO_3^-] + 2[CO_3^{2-}] + [OH^-] - [H^+]$
We will talk more about Alkalinity in the next lecture

2. Calculate Charge Balance

Check Correctness of Analysis: Calculate TDS

Solute	Measured Conc (mg/L)
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Mg^{2+}	34.0
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Fe(III)	0.1
HCO_3^{-}	325.0
SO_4^{2-}	84.0
Cl^{-}	9.6
NO_3^{-}	13.0

Calculated TDS =
0.6Alkalinity + Na + K + Ca + Mg + Cl + SO_4 + SiO_2 + NO_3-N + F

Alkalinity = $[HCO_3^-] + 2[CO_3^{2-}] + [OH^-] - [H^+]$ = 325

Calculated TDS = 567.2 mg/L

Measured value in this case 603.5 mg/L
What is the ratio? Is it acceptable?

ratio = 1.06 is acceptable

Check the cation/anion balance for this analysis:

Solutes	Measured Conc. (mg/L)	Atomic weight(g)	Molarity (mmol/L)	Valence (charge)	meq/L	
Ca^{2+}	92.0	40.08	2.30	2	4.60	
Mg^{2+}	34.0	24.31	1.40	2	2.80	
Na^{+}	8.2	23.0	0.36	1	0.36	7.79
K^{+}	1.4	39.1	0.036	1	0.036	
Fe(III)	0.1	55.8	0.002	3	0.006	
HCO_3^{-}	325.0	61.0	5.33	1	5.33	
SO_4^{2-}	84.0	96.0	0.88	2	1.75	7.56
Cl^{-}	9.6	35.5	0.27	1	0.27	
NO_3^{-}	13.0	62.0	0.21	1	0.21	

$$\frac{\sum \text{cations} - \sum \text{anions}}{\sum \text{cations} + \sum \text{anions}} = \frac{7.79 - 7.56}{7.79 + 7.56} = 0.0145$$

Summary checking correctness of analysis

1. **Check Calculated vs Measured TDS**

$$\frac{\text{measured TDS}}{\text{calcuated TDS}} = \frac{603.5}{567.2} = 1.06$$

Between 1 and 1.2, so it's OK!

2. **Check Anion-Cation (Charge) Balance**

$$\frac{\sum \text{cations} - \sum \text{anions}}{\sum \text{cations} + \sum \text{anions}} = \frac{7.79 - 7.56}{7.79 + 7.56} = 0.0145$$

The cation/anion imbalance for the data is 1.5%
< 5% so it's OK!

Plotting on a Piper Diagram

Ca 40 ppm
Mg 15 ppm
Na 120 ppm
K 20 ppm
HCO_3^- 2.8 meg/L
SO_4 234 ppm
Cl 45 ppm

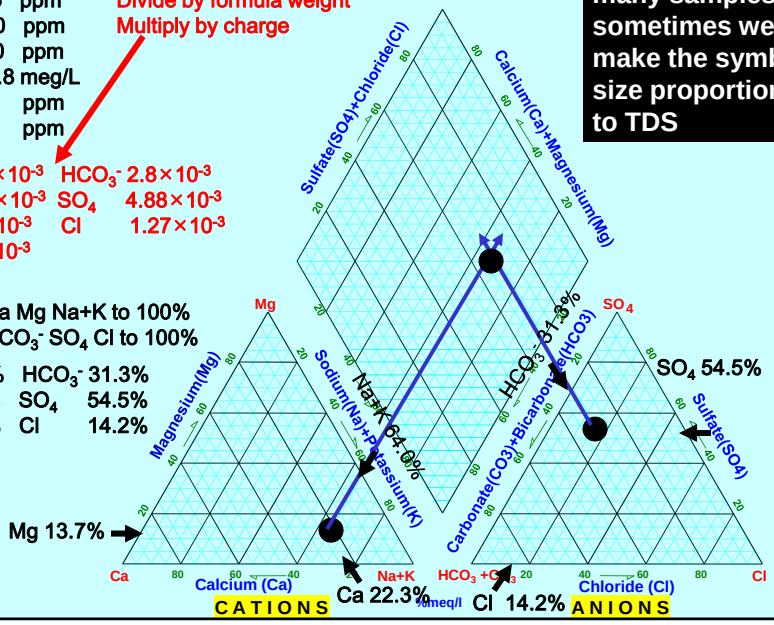
Convert to Equivalents / L
Divide by formula weight
Multiply by charge

Ca 1.996×10^{-3} HCO_3^- 2.8×10^{-3}
Mg 1.234×10^{-3} SO_4 4.88×10^{-3}
Na 5.22×10^{-3} Cl 1.27×10^{-3}
K 0.51×10^{-3}

Sum Na+K
Normalize Ca Mg Na+K to 100%
Normalize HCO_3^- SO_4 Cl to 100%

Ca 22.3% HCO_3^- 31.3%
Mg 13.7% SO_4 54.5%
Na+K 64.0% Cl 14.2%

When plotting many samples sometimes we make the symbol size proportional to TDS



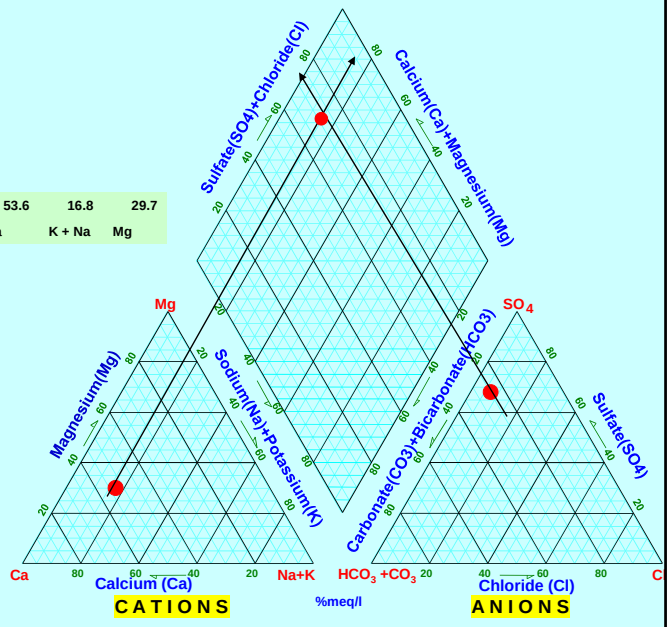
Plot on a Piper Diagram distributed in class

Ca 131 ppm
Mg 44 ppm
Na 43 ppm
K 7 ppm
HCO_3^- 200 ppm
SO_4 431 ppm
Cl 19 ppm

25.6	4.2	70.2	53.6	16.8	29.7
Bicarb+Carb	Chloride	Sulfate	Ca	K + Na	Mg

Plotted point is approximate given ppt drawing limitations

THIS IS THE WILD ROSE SAMPLE FORM THE DEATH VALLEY DATA SEY



The sample data that you just plotted on the paper Piper diagram in class is one of the Death Valley samples, Wildrose Spring. Compare your plotted point to the one that Rockware plots.

Consider the Data with respect to the maps on the next two slides. (note: we will discuss these again in an upcoming class)

HOMEWORK:
Make an interesting observation using Rockworks on one of these data sets.
You must attach the associated
Rockworks diagram and explain how it supports your observation