## *Practical: Exercise 3. Hydrogeochemistry of Faryab*

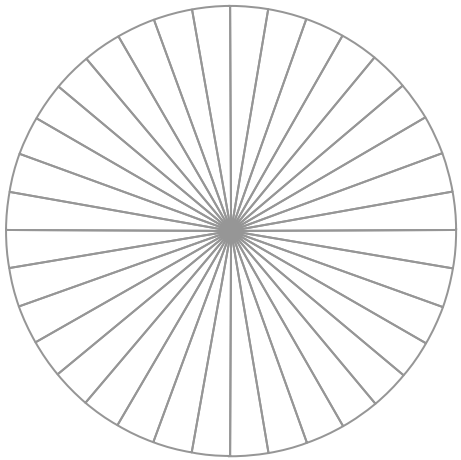
The four analyses below are from real groundwaters in Pas Sang (Kohistan), Qor Qol (Qaysar), Nawabad (Bilchiragh) and Tawachi (Andkhoi)

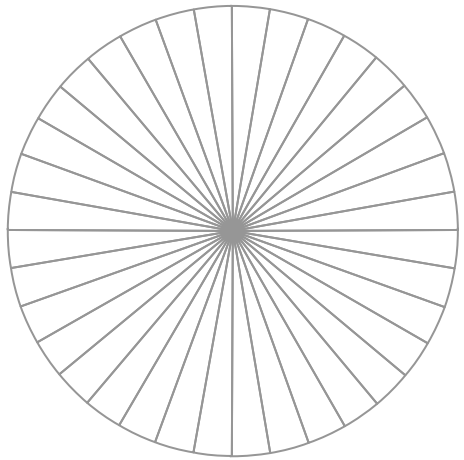
| | | Pas Sang | mmol/l | meq/l | Qor Qol | mmol/l | meq/l | Nawabad | mmol/l | meq/l | Tawachi | mmol/l | meq/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH | | 8.0 | | | 8.6 | | | 7.3 | | | 7.8 | | |
| Electrical Conductivity | µS/cm | 356 | | | 940 | | | 2450 | | | 10070 | | |
| $Na^+$ | mg/l | 7.8 | | | 59.1 | | | 172 | | | 1469 | | |
| $K^+$ | mg/l | 0.92 | | | 6.08 | | | 5.88 | | | 26.0 | | |
| $Ca^{++}$ | mg/l | 55.3 | | | 67.5 | | | 88.1 | | | 218 | | |
| $Mg^{++}$ | mg/l | 7.06 | | | 60.5 | | | 189 | | | 580 | | |
| $SO_4^=$ | mg/l | 17.3 | | | 189 | | | 394 | | | 2486 | | |
| $NO_3^-$ | mg/l | 6.12 | | | 24.6 | | | 43.3 | | | 88.0 | | |
| $Cl^-$ | mg/l | 2.15 | | | 34.4 | | | 179 | | | 1919 | | |
| $F^-$ | mg/l | 0.13 | | | 0.20 | | | 0.87 | | | 1.81 | | |
| HCO3- | mg/l | 198 | | | 331 | | | 781 | | | 846 | | |

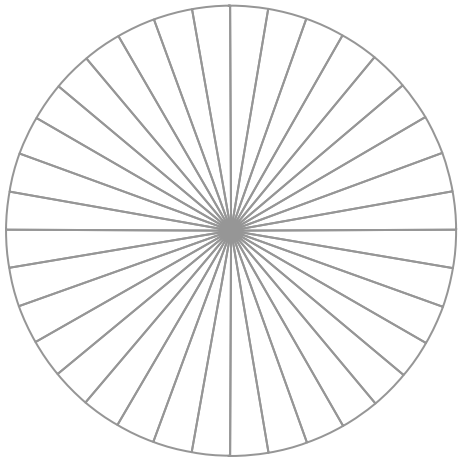
Convert the analyses first to mmol/l and then to meq/l (use the atomic masses provided).
For each water, state the dominant cation and anion in terms of milliequivalents per litre. Calculate the ion balance.
What are the main differences that you notice between the various samples?
Plot the analyses as pie diagrams, and on the Durov diagram

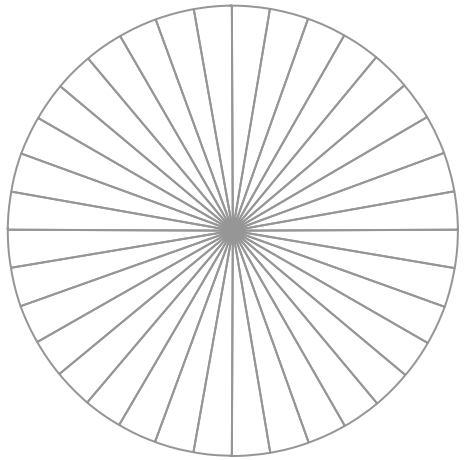
| Symbol | **Name** | **Atomic mass (g/mol)** |
|---|---|---|
| **N** | Nitrogen | 14.007 |
| **O** | Oxygen | 15.999 |
| **F** | Fluorine | 18.998 |
| **Na** | Sodium | 22.99 |
| **Mg** | Magnesium | 24.305 |
| **S** | Sulphur | 32.066 |
| **Cl** | Chlorine | 35.453 |
| **K** | Potassium | 39.098 |
| **Ca** | Calcium | 40.078 |

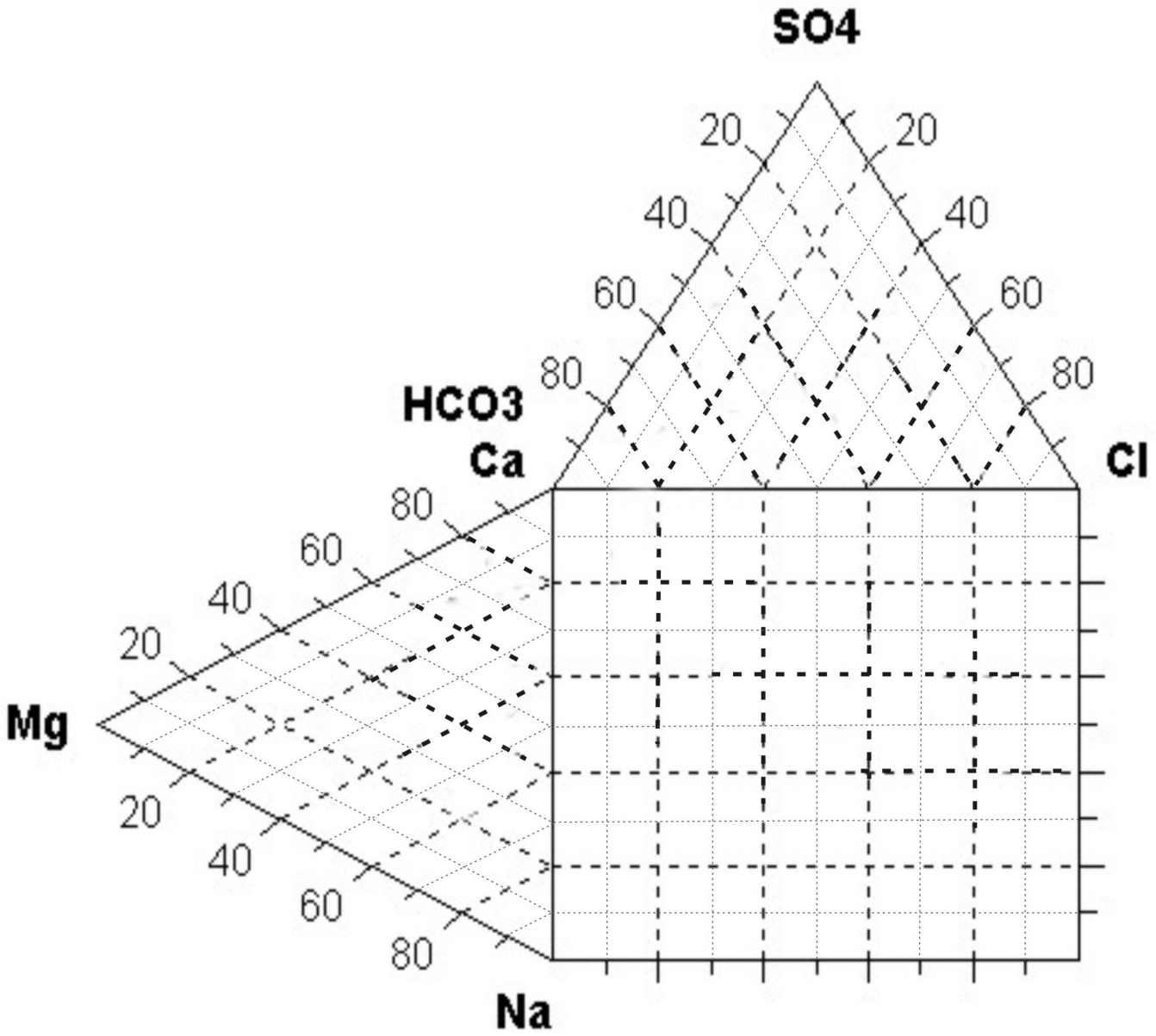
Note: pH = $-\log_{10}(H^+)$, where $(H^+)$ is the activity of hydrogen ions in moles per litre.
To convert mg/l to mmol/l: Conc (mmol/l) = Conc (mg/l) / atomic mass
To convert mmol/l to meq/l: Conc (meq/l) = Conc (mmol/l) x Ionic Charge












Durov diagram