

Practical: Exercise 2. Hydrogeochemistry of Granite Island, Hvaler, Norway

Two wells were sampled in a granitic aquifer, together with rainfall and a sample of surface water run-off from a small stream draining the granite outcrop. The analytical results are presented in the Tables below:

		Rainfall	mmol/l	meq/l	Surface runoff	mmol/l	meq/l	Borehole 1	mmol/l	meq/l	Borehole 2	mmol/l	meq/l
pH		4.3			3.53			6.86			7.87		
Elec.Cond.	μS/cm				274			179			388		
Na ⁺	mg/l	1.2			23.8			21.81			80.2		
K ⁺	mg/l	0.47			0.65			0.87			4.07		
Ca ⁺⁺	mg/l	0.36			2.06			10.01			13.97		
Mg ⁺⁺	mg/l	0.21			3.11			2.09			4.15		
SO ₄ ⁼	mg/l	2.03			16.8			17.8			12.4		
NO ₃ ⁻	mg/l	4.01			0.22			<0.05			<0.05		
Cl ⁻	mg/l	2.95			41.8			30.9			34.5		
F ⁻	mg/l	<0.1			0.33			0.25			2.86		
Alkalinity	meq/l	0			0			0.33			2.81		

Convert the analyses first to mmol/l and then to meq/l (use the atomic masses provided).

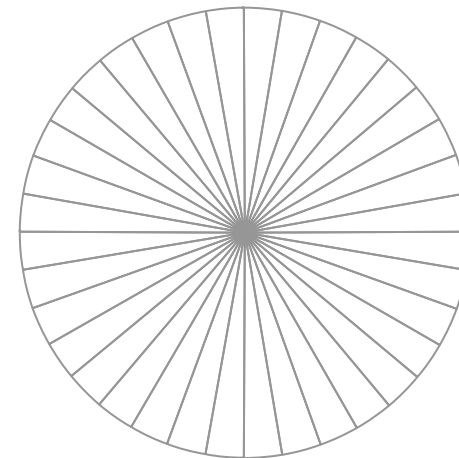
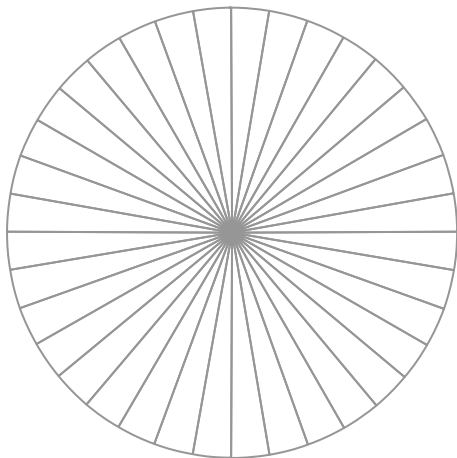
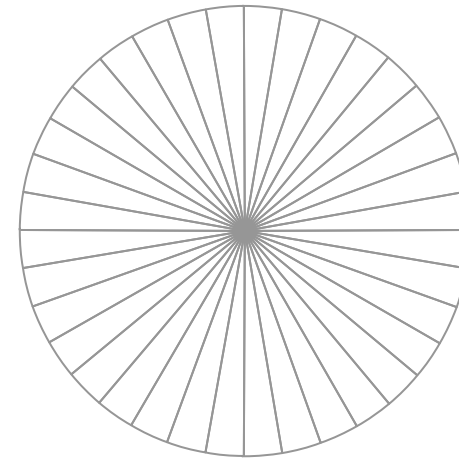
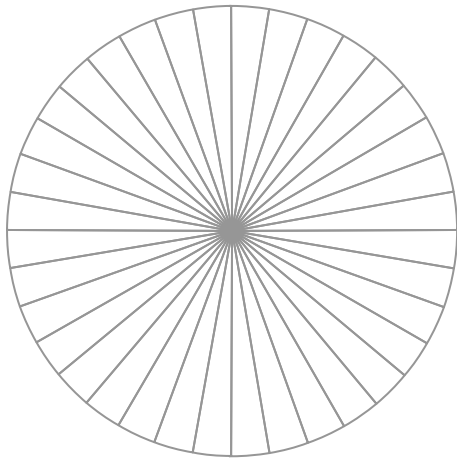
For each water, state the dominant cation and anion in terms of milliequivalents per litre. Calculate the ion balance.

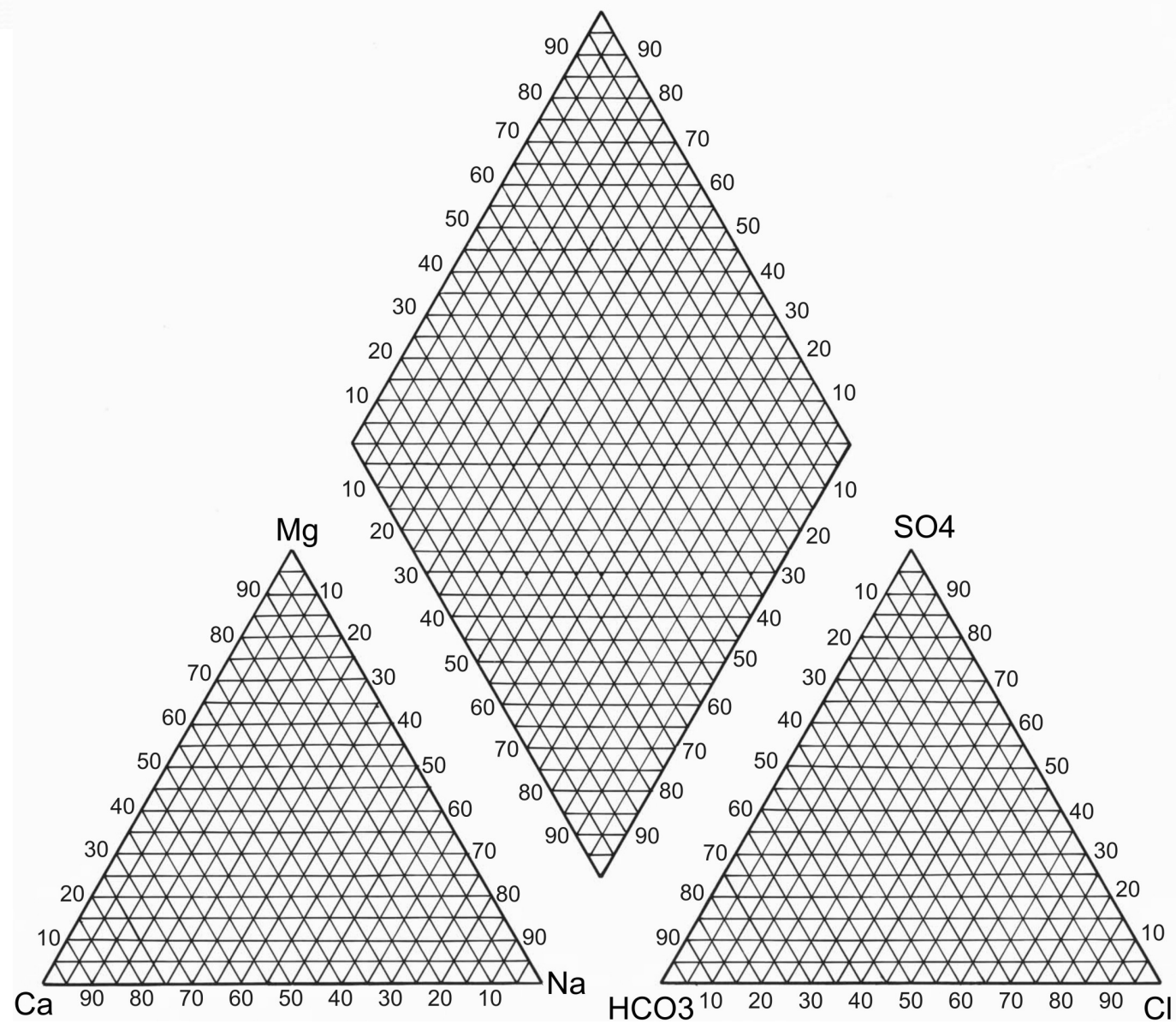
What are the main differences that you notice between the various samples?

Plot the analyses as pie diagrams, on the Piper Diagram and on the Durov diagram

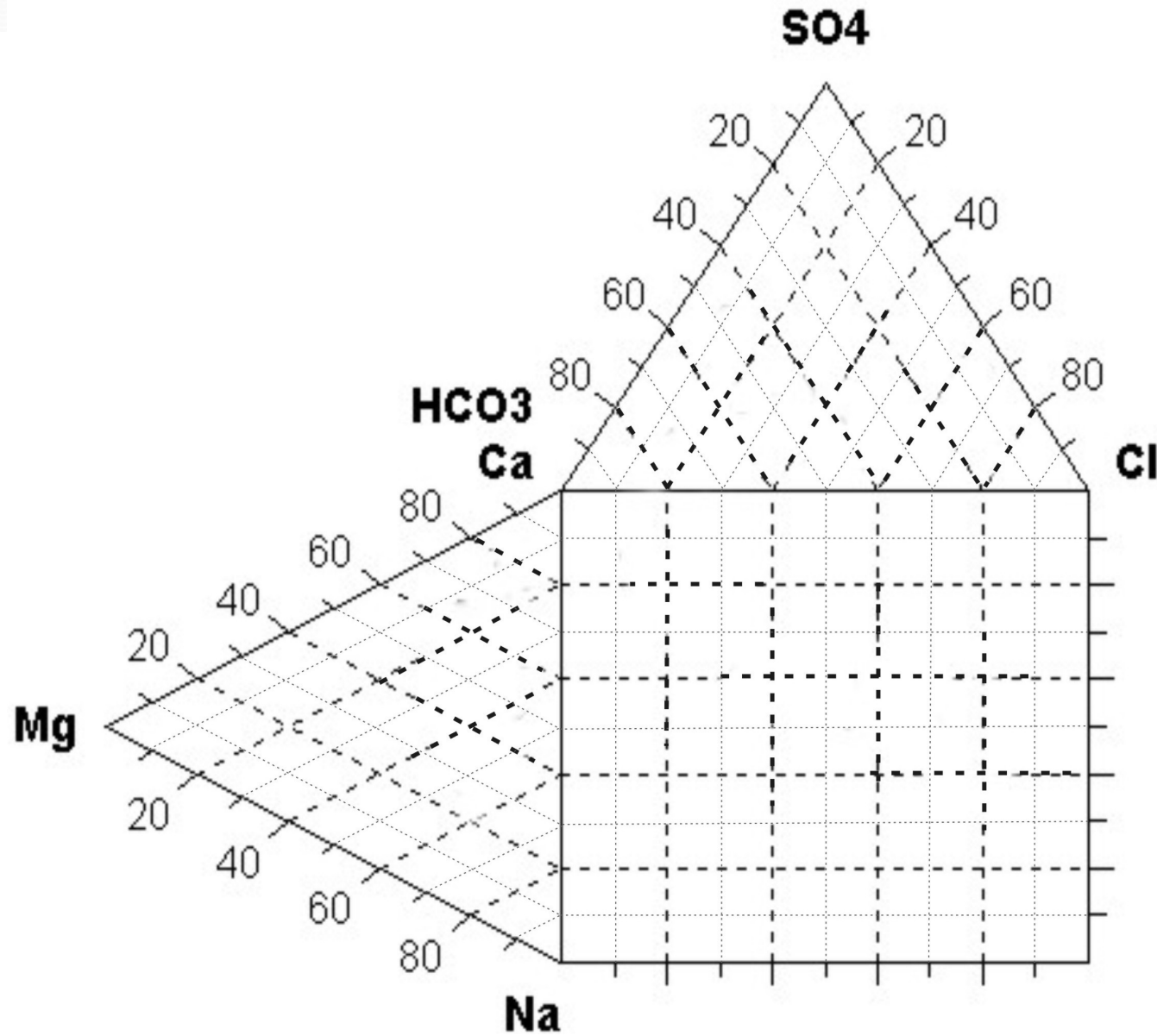
Symbol	Name	Atomic mass (g/mol)
N	Nitrogen	14.007
O	Oxygen	15.999
F	Fluorine	18.998
Na	Sodium	22.99
Mg	Magnesium	24.305
S	Sulphur	32.066
Cl	Chlorine	35.453
K	Potassium	39.098
Ca	Calcium	40.078

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





Piper diagram



Durov diagram