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İyonların Atom Ağırlığı ve ekivalen değerleri

İyonlar	Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
Atom veya formül ağırlığı	40	24	23	39	35,5	96	61	60
Değerlik	2	2	1	1	1	2	1	2
Ekivalen değeri (eşdeğer ağırlığı)	20	12	23	39	35,5	48	61	30

Canik (2007)

Çözünmüş maddeler için konsantrasyon birimleri

mg/L	milligrams per liter sample
µg/L	micrograms per liter sample
ppm	parts per million by weight of sample
ppb	parts per billion by weight of sample
mmol/L	millimoles per liter sample
µmol/L	micromoles per liter sample
meq/L	milliequivalents per liter of sample
$mmol_c$/L	milliequivalents per liter of sample
epm	equivalents per million, by weight of sample
M	molality, moles per kg of H_2O
mM	millimoles per kg of H_2O
N	normality, equivalents per liter

$$\text{mmol/L} = \text{mg/L} / (\text{gram formula weight})$$

$$\text{mmol/L} = \text{ppm} \cdot (\text{density of sample}) / (\text{gram formula weight})$$

$$\text{mmol/L} = \text{meq/L} / (\text{charge of ion})$$

$$\text{mmol/L} = \text{molality} \times \text{density} \times \frac{(\text{weight solution} - \text{weight solutes})}{(\text{weight solution})} \times 1000$$

Appelo and Postma (2005)

Konsantrasyon birimlerinin yeniden hesaplanması-Dönüştürmeler (mg/l, mek/l, mmol/l)

EXAMPLE 1.1. *Recalculation of concentration units*

1. Gram formula weights are calculated from the periodic system as reproduced in Table 1.4 from the *Handbook of chemistry and physics*.
   The mass of 1 mol Ca is 40.08 grams.
   1 mol SO_4^{2-} weighs: 32.06 grams from sulfur + 4 × 15.9994 grams from oxygen, in total: 96.06 grams.
2. Conversion of mg/L to mmol/L is obtained by dividing by the weight of the element or molecule.
   Thus, a river water contains 1.2 mg Na^+/L;
   This corresponds to $1.2/22.99 = 0.052$ mmol Na^+/L;
   The sample also contains 0.6 mg SO_4^{2-}/L;
   This equals $0.6/96.06 = 0.006$ mmol SO_4^{2-}/L.
3. The term mmol/L indicates the number of ions or molecules in the water when multiplied by Avogadro's number. For Na^+ in the river water sample it amounts to $0.052\times10^{-3} \times 6.022\times10^{23} = 3.1\times10^{19}$ ions of Na^+ in 1 liter of water. (Quite a lot really!)
4. Ions are electrically charged, and the sums of positive and negative charges in a given water sample must balance. This condition is termed the electroneutrality or electrical balance of the solution. Since mmol/L represents the number of molecules, it should be multiplied by the charge of the ions to yield their total charge in meq/L. Thus:
   0.052 mmol Na^+/L × 1 = 0.052 meq/L;
   1.8 mmol Ca^{2+}/L × 2 = 3.6 meq/L;
   0.41 mmol SO_4^{2-}/L × −2 = −0.82 meq/L.

Appelo and Postma (2005)

Yaygın parametrelerin açıklaması

Hardness	Sum of the ions which can precipitate as "hard particles" from water. Sum of Ca^{2+} and Mg^{2+}, and sometimes Fe^{2+}. Expressed in meq/L or mg $CaCO_3$/L or in hardness degrees. 100 mg $CaCO_3$/L ≅ 1 mmol $CaCO_3$/L ≅ 2 meq Ca^{2+}/L
Hardness degrees	1 german degree = 17.8 mg $CaCO_3$/L 1 french degree = 10 mg $CaCO_3$/L
Temporary hardness	Part of Ca^{2+} and Mg^{2+} concentrations which are balanced by HCO_3^- (all expressed in meq/L) and can thus precipitate as carbonate
Permanent hardness	Part of Ca^{2+} and Mg^{2+} in excess of HCO_3^- (all expressed in meq/L)
Color	Measured by comparison with a solution of cobalt and platinum
EC	Electrical Conductivity, in µS/cm (= µmho/cm), $EC \approx 100 \times$ meq (anions or cations)/L
pH	$-\log[H^+]$, the log of H^+ activity (dimensionless).
Eh	Redox potential, expressed in Volt. measured with platinum/reference electrode
pe	Redox potential expressed as $-\log[e^-]$. $[e^-]$ is "activity" of electrons. $pe = Eh/0.059$ at 25°C.
Alkalinity (*Alk*)	Acid neutralizing capacity. Determined by titrating with acid down to a pH of about 4.5. Equal to the concentrations of $m_{HCO_3^-} + 2\,m_{CO_3^{2-}}$(mmol/L) in most samples.
Acidity	Base neutralising capacity. Determined by titrating up to a pH of about 8.3. Equal to H_2CO_3 concentration in most samples except when Al^{3+} or Fe^{3+} are present
TIC	Total inorganic carbon
TOC	Total organic carbon
COD	Chemical oxygen demand. Measured as chemical reduction of permanganate or dichromate solution, and expressed in oxygen equivalents
BOD	Biological oxygen demand.

Appelo and Postma (2005)

Analiz için alınan su örneklerinin kimyasal parametrelerinin korunması

Parameter	Conservation/field analysis
Na^+, K^+, Mg^{2+}, Ca^{2+} NH_4^+, Si, PO_4^{3-}	Acidify to pH <2 in polyethylene container (preferably HNO_3 for AAS or ICP-analysis).
Heavy metals	Acidify to pH <2 in glass or acid rinsed polypropylene container.
SO_4^{2-}, Cl^-	Cool to 4°C.
NO_3^-, NO_2^-	Store cool at 4°C and analyze within 24 hours or add bactericide like thymol. (Note that NO_3^- may form from NH_4^+ in reduced samples. NO_2^- may self-decompose even when a bactericide is added.)
H_2S	To avoid degassing, collect sample in a Zn-acetate solution, precipitating ZnS. Spectrophotometry in the field or later in the laboratory.
TIC	Dilute sample to $TIC < 0.4$ mmol/L. (This effectively reduces CO_2 pressure, and prevents the escape of CO_2).
Alkalinity	Field titration with the GRAN method (Stumm and Morgan, 1996)
Fe^{2+}	Spectrophotometry in the field. Alternatively determined as Fe-total in an acidified sample.
pH, Temp., *EC*, O_2	Field measurement in a flow cell.
CH_4	Unfiltered sample collected avoiding degassing, then acidified.

Appelo and Postma (2005)

Suda Çözünen Elementlerin Kökeni

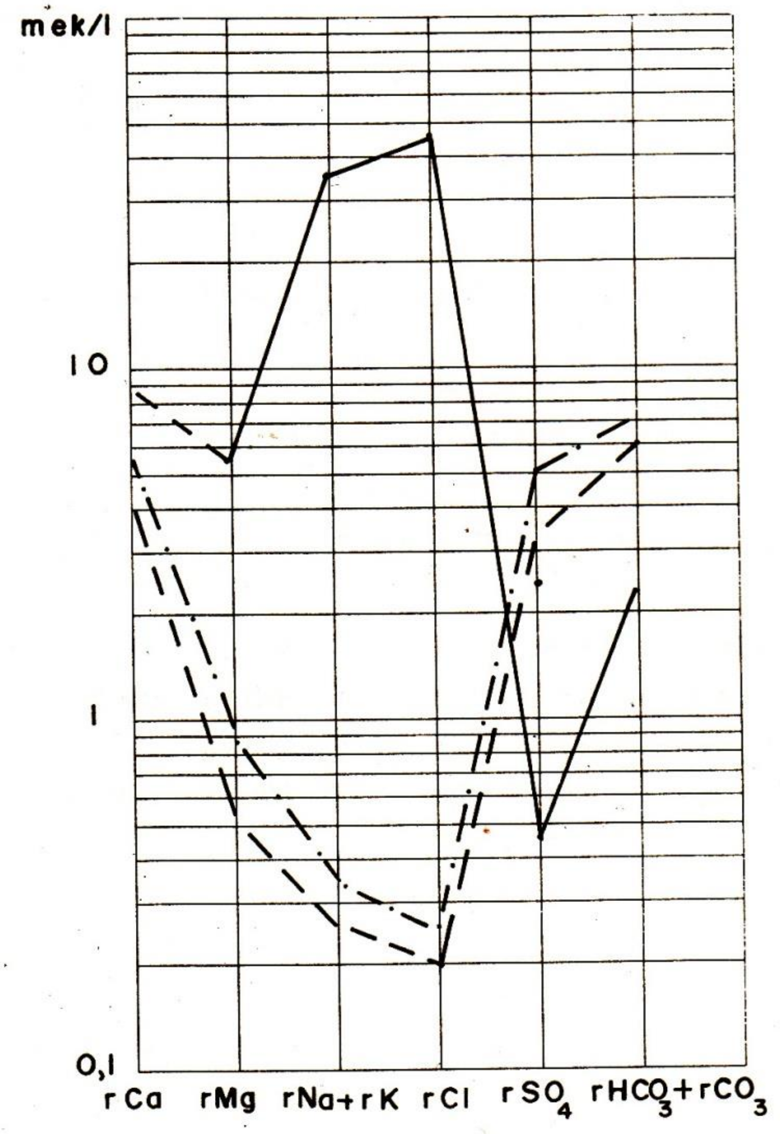
Element	Köken	Azalması
Ca^{+2}	Karbonatların çözünmesi Jipsler, piroksen, amfibol, feldspat, dolomit, kil mineralleri	İyon değişimi Karbonat minerallerinin çökelmesi
Mg^{+2}	Karbonat minerallerinin çözünmesi Olivin, piroksen, amfibol, magnezit, kil mineralleri	İyon değişimi
Na+	Killer, feldspat (albit), evaporit (halit), endüstriyel atıklar, mirabilit (Na2SO4.10H2O)	İyon değişimi
K^{+}	Feldspat, k-evaporitler, gübreler, feldspatoid, bazı mikalar, kil mineralleri, silikatların çözünmesi	İyon değişimi
SiO_2	Silikatların hidrolizi, Amorf silika (çört, opal), feldspat, ferromagnezyum, kil mineralleri	
Fe	Sülfitlerin oksidasyonu Hematit ve pirit, demir boruların korozyonu, derinlik kayaçları: amfibol, ferromagnezyumlu mikalar, demirli sülfit, demirli sülfit veya demirli pirit, magnetit, Kumtaşı: oksitler, karbonatlar, Sülfitler veya demirli kil mineralleri	
Cl^{-}	Deniz suyu, gübre, yağış, doğal acı sular, yol tuzlaması, rüzgarlar tarafından taşınan malzeme, evaporit çökelleri, kirlilik, derinlik kayaçlarından minör miktarda	İnert-konzervatif
SO_4^{-2}	Sülfit yataklarının oksidasyonu, jips, anhidrit, deniz suyu, rüzgarla taşınan maddeler, piritin oksidasyonu, bakteriyel indirgenme, gübreler	Çok indirgen şartlar haricinde konzervatif
HCO_3^{-} CO_3^{-2}	Kireçtaşı, dolomit çözünmesi, zemin ve atmosferik CO_2	Karbonat minerallerinin çökelmesi
NO_3^{-}	Sentetik ve organik gübre, gübre kaynaklı NH_4 nitrifikasyonu, rüzgarla taşınan maddeler, amonyumun oksidasyonu, kirlilik oluşumu, baklagiller ve bitki artıkları, hayvan dışkısı	Anaerobik şartlarda denitrifikasyon (nitratın amonyuma dönüşmesi)

Grafiksel Değerlendirmeler

- ❖Üçgen Diyagram,
- ❖Schoeller diyagramı,
- ❖Piper Diyagramı,
- ❖Bar Diyagramı,
- ❖Dairesel Diyagram,
- ❖Stiff Diyagramı

Su Hayattır...

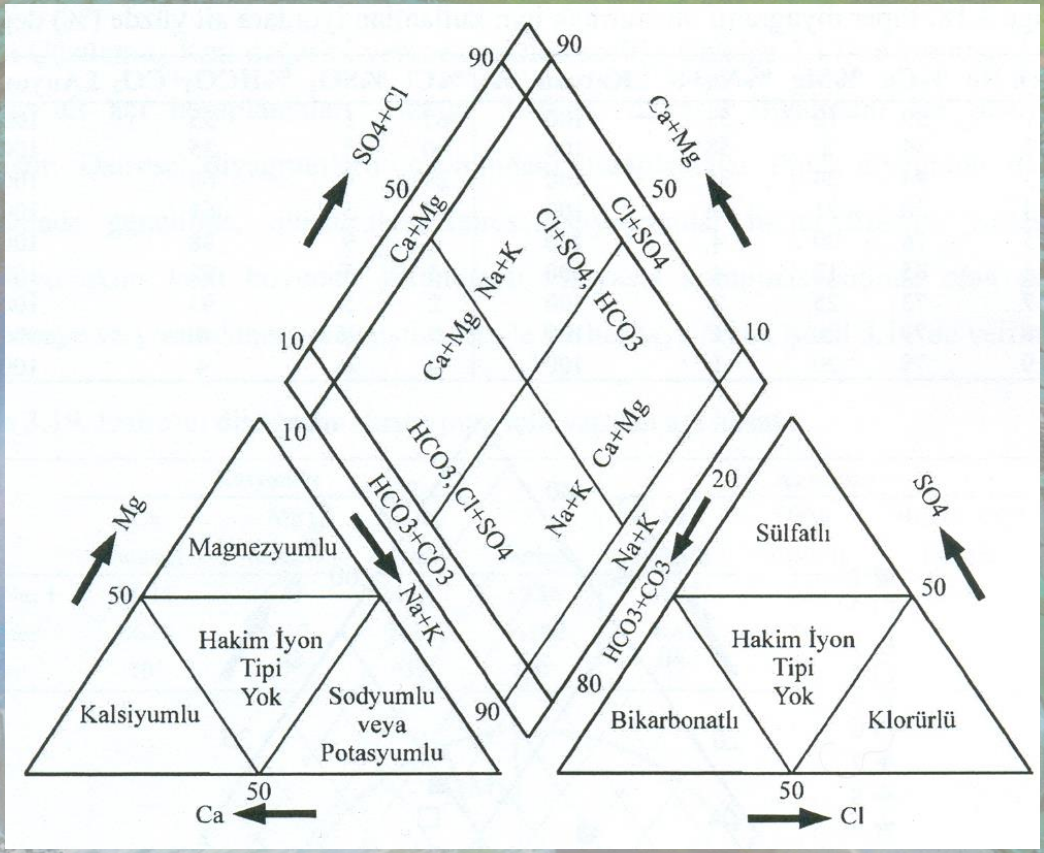
Schoeller Yarı Logaritmik Diyagramı (örnek uygulama)



Schoeller diyagramı

Canik (2007)

Piper Diyagramı



Domenico and
Schwarz (1990)

Su Hayattır...

Bar Diyagramı

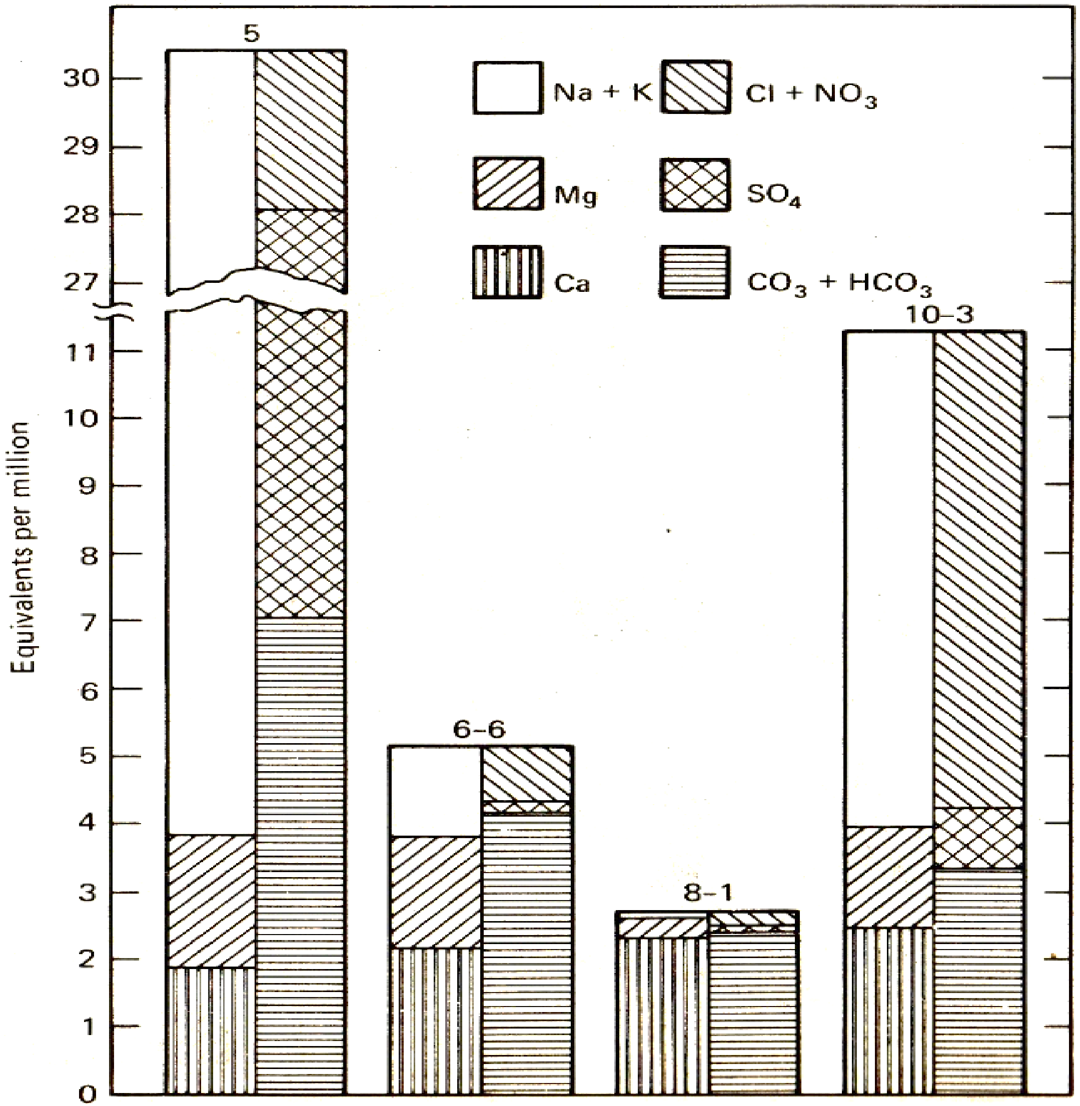


Fig. 7.3 Vertical bar graphs for representing analyses of groundwater quality (after Hem[23]).

Hem (1985)

Dairesel Diyagramlar

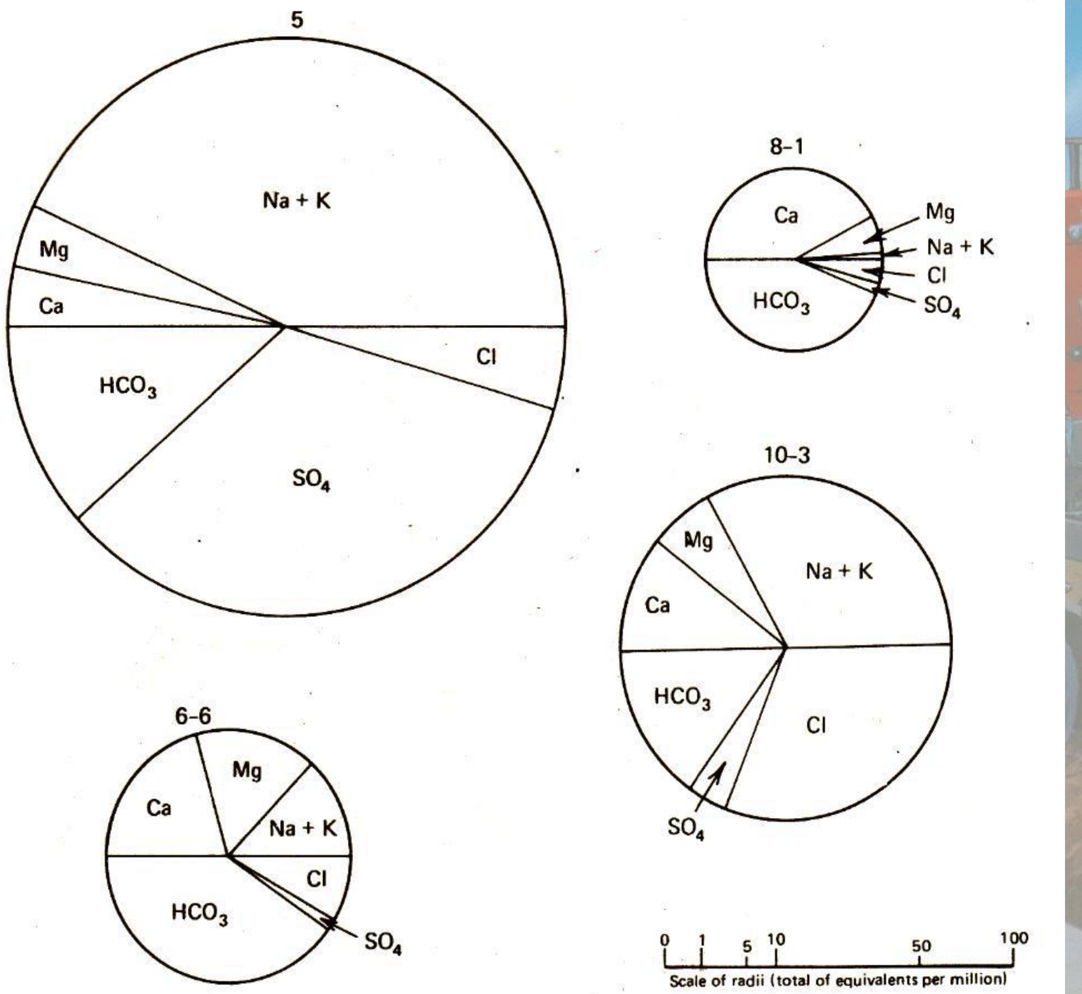
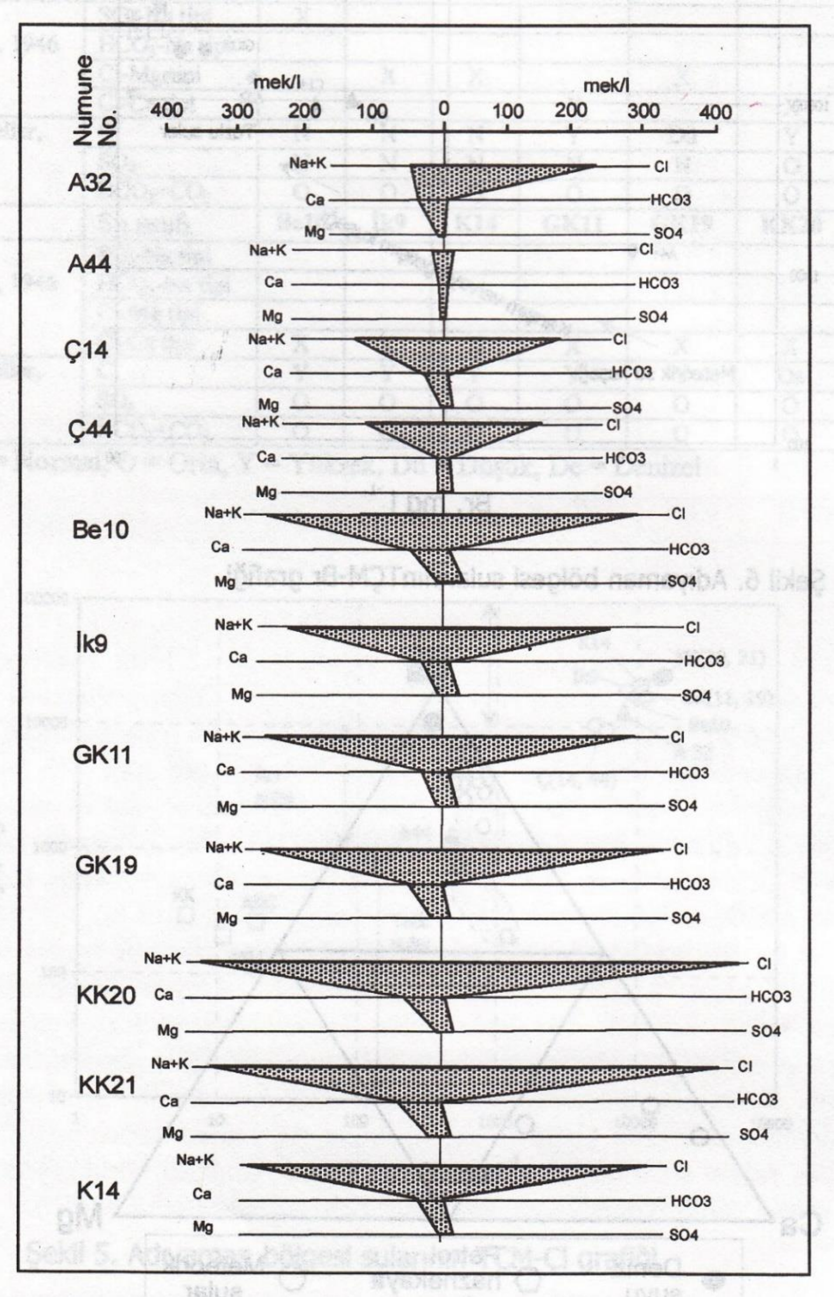


Fig. 7.6 Circular diagrams for representing analyses of groundwater quality (after Hem[23]).

Hem (1985)

Stiff Diyagramı



Çelik (2001)