SPRINGS

A spring is a concentrated discharge of groundwater appearing at the surface as a current of flowing water. (Seepage areas- indicate a slower movement of groundwater to the ground surface. Well established in the engineering literature in connection with groundwater movement from and to surface bodies, particularly where associated with structures such as dams, canals, etc.

A spring in Kazan Basin (Ankara)

A spring in Kütahya Köprüören Basin

Spring areas may pond.

Springs occur in many forms and have been classified as to cause, rock structure, discharge, temperature and variability.

Springs resulting from nongravitational forces

Volcanic springs

Fissure springs- resulting from fractures extending to great depths in the earth's crsut.

Springs resulting from gravitational forces

Gravity springs result from water flowing under hydrostatic pressure.

1) Depression Springs
2) Contact Springs
3) Artesian Springs
4) Impervious Rock Springs
5) Tubular or Fracture Springs

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Springs resulting from nongravitational forces

Springs resulting from gravitational forces

Gravity springs result from water flowing under hydrostatic pressure.

1) Depression Springs
2) Contact Springs
3) Artesian Springs
4) Impervious Rock Springs- Occuring in tubular channels or fractures of impervious rocks.
5) Tubular or Fracture Springs- Issuing from rounded channels, such as lava tubes or solution channels, fractures in impermeable rock connecting with groundwater.

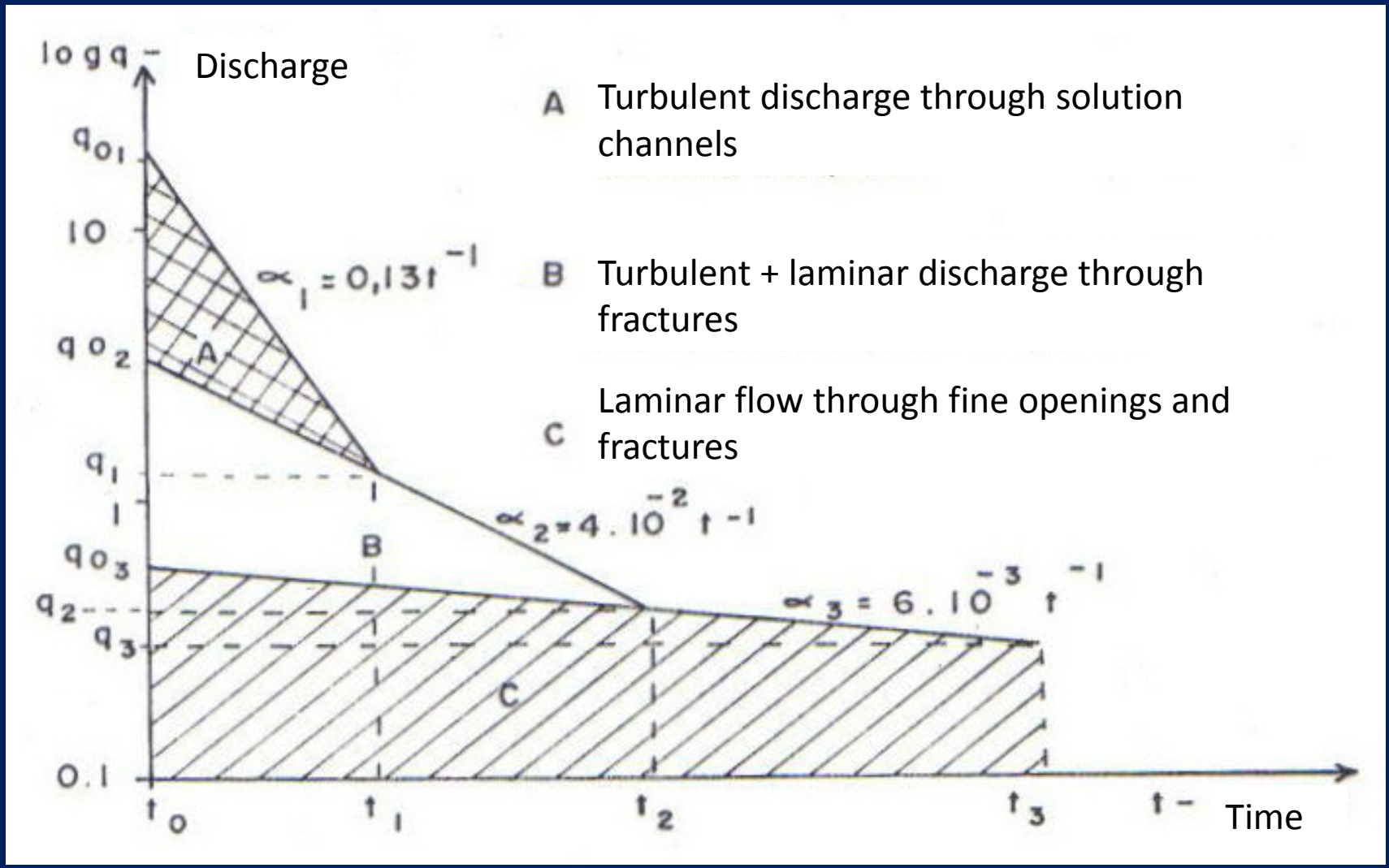
Springs, especially those in arid regions, are renowned as hotspots of biological and cultural diversity, and the presence of endangered or unique species and ethnological and historical resources often greatly influences their management (Springer and Stevens, 2009).

Ecological and cultural variables relevant to springs classification include:

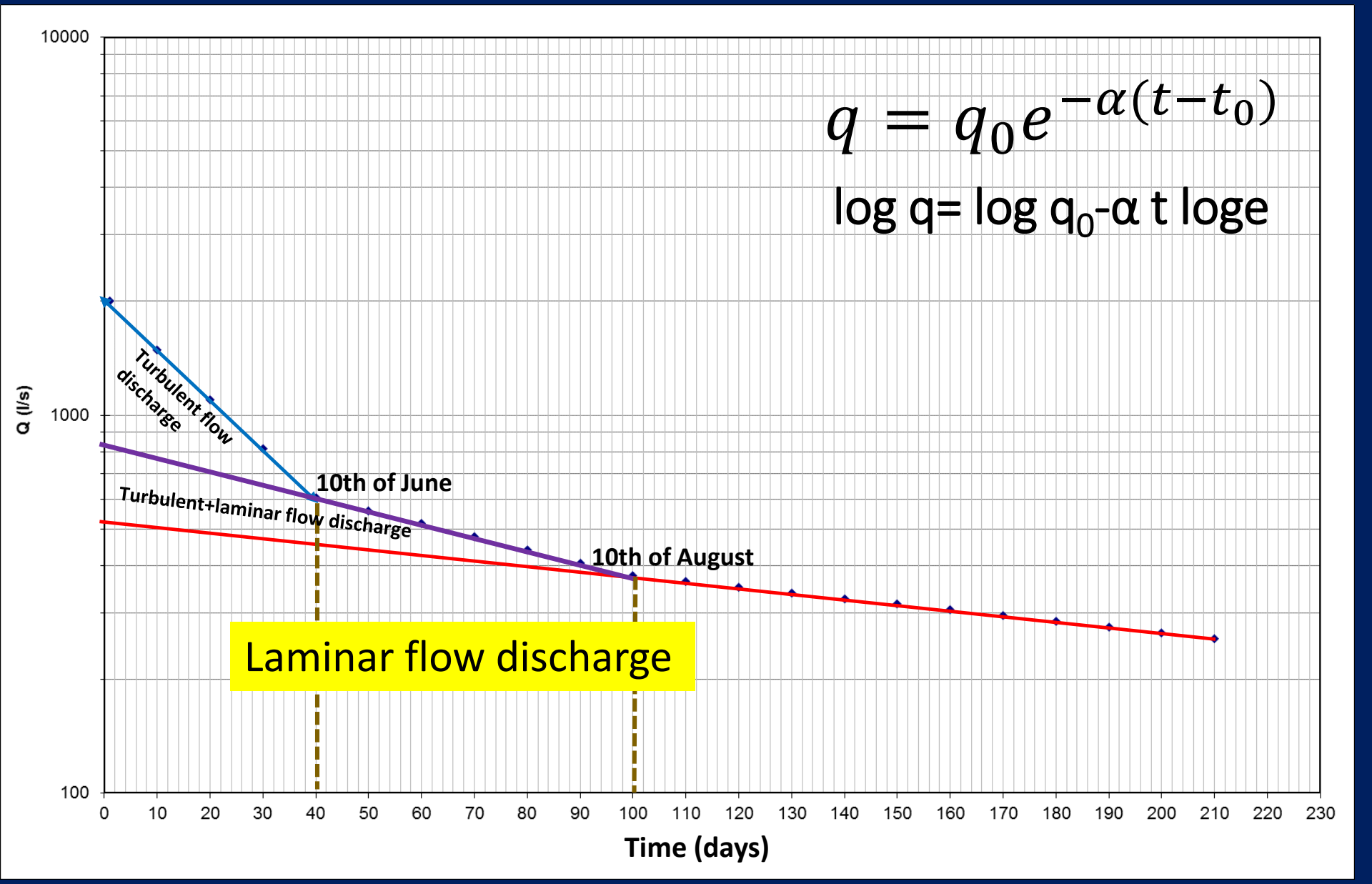
a) size, spatial isolation
b) Microhabitat distribution
c) Paleontological resources
d) The presence of rare or endemic biota
e) Archeological or traditional cultural resources

Springer, A. E., Stevens, L. E. 2009. Spheres of discharge of springs. Hydrogeology Journal 17, 83-93

SPRING DISCHARGE HYDROGRAPH
Responses of spring discharge to precipitation
RECESSION CURVES



Components of a semi-log hydrograph of a spring


$q = q_0 e^{-\alpha(t-t_0)}$
log q= log q_0-α t loge
10000
1000
100
Q (l/s)
Turbulent flow discharge
10th of June
Turbulent+laminar flow discharge
10th of August
Laminar flow discharge
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Time (days)

The storage capacity of a karstic spring:

$$Vo = \int_0^{\infty} q dt$$

....

.....

$$V_0 = \frac{q_0 86400}{\alpha} \quad 1/\text{day}$$

If q_0 m³/s then Vo m³

Çizelge 1. Karstik kaynağın zamana bağlı boşalım (debi) değerleri

Zaman (t, gün)	Q,l/s
1 Mayıs	2000
10 Mayıs	1485
20 Mayıs	1100
30 Mayıs	815
10 Haziran	605
20 Haziran	559
30 Haziran	516
10 Temmuz	477
20 Temmuz	440
30 Temmuz	406
10 Ağustos	375
20 Ağustos	362
30 Ağustos	350
10 Eylül	338
20 Eylül	327
30 Eylül	316
10 Ekim	305
20 Ekim	295
30 Ekim	285
10 Kasım	275
20 Kasım	265
30 Kasım	256

Toros kuşağında yer alan Mesozoyik yaşlı karstik kireçtaşları ile Eosen yaşlı geçirimsiz filiş birimlerinin dokanağından boşalan bir kaynakta zamana bağlı olarak debiler ölçülmüştür (Çizelge 1). Mesozoyik kireçtaşları Eosen fliş üzerine bindirmeli olarak gelmektedir.

Zaman (t, gün)	Q,l/s	
1 Mayıs	2000	1
10 Mayıs	1485	10
20 Mayıs	1100	20
30 Mayıs	815	30
10 Haziran	605	40
20 Haziran	559	50
30 Haziran	516	60
10 Temmuz	477	70
20 Temmuz	440	80
30 Temmuz	406	90
10 Ağustos	375	100
20 Ağustos	362	110
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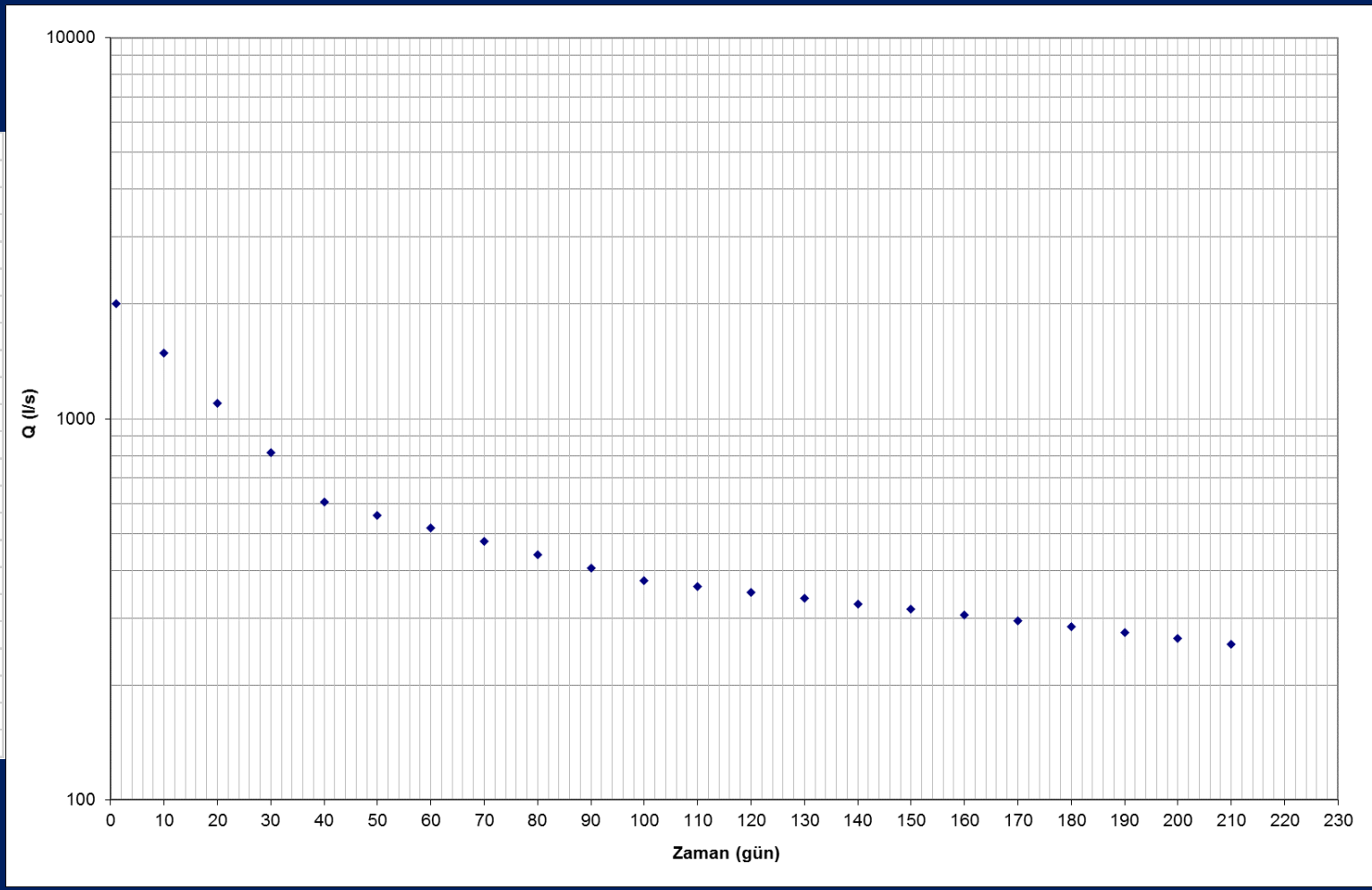
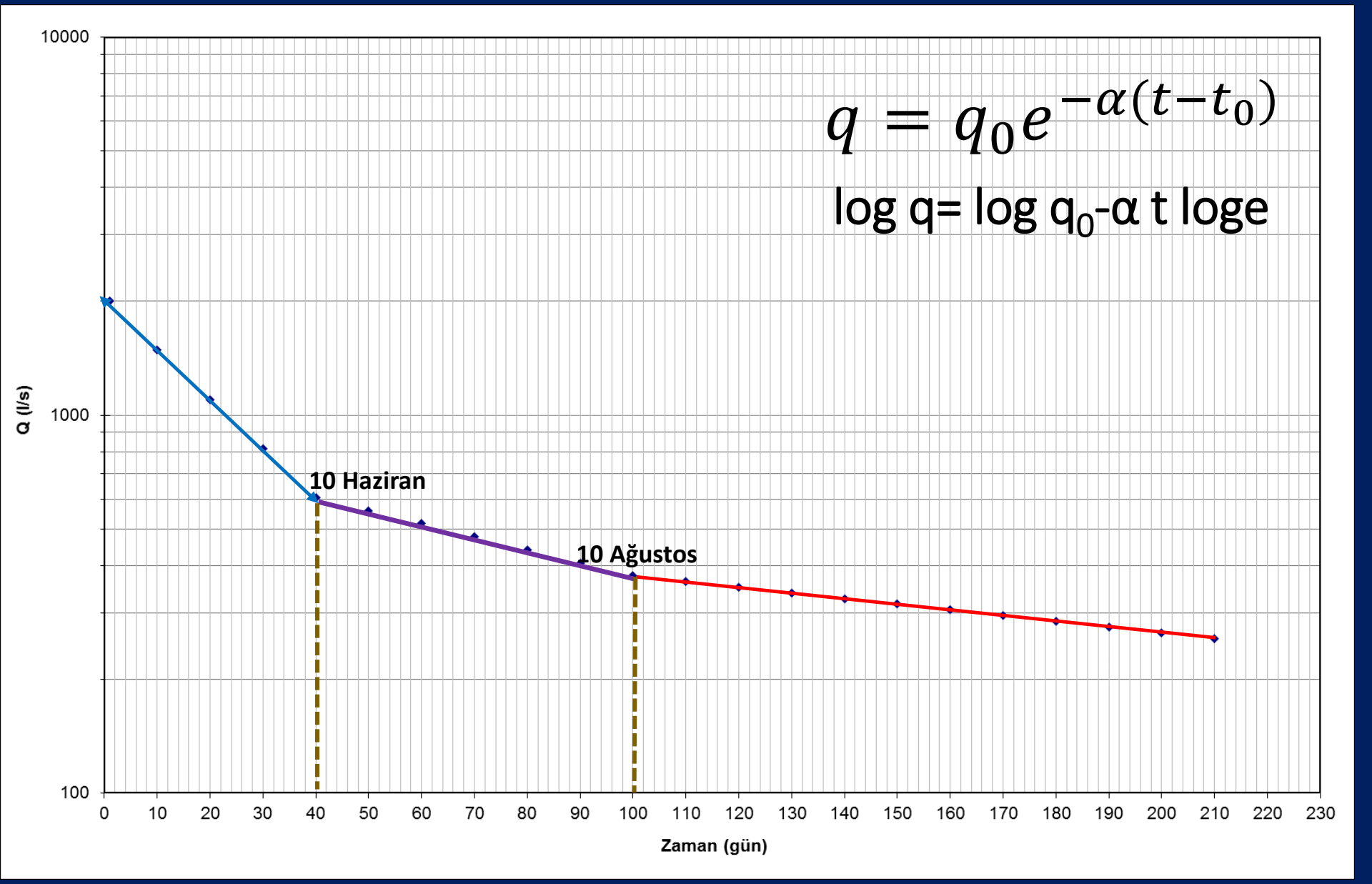
10 Eylül	338	130
20 Eylül	327	140
30 Eylül	316	150
10 Ekim	305	160
20 Ekim	295	170
30 Ekim	285	180
10 Kasım	275	190
20 Kasım	265	200
30 Kasım	256	210

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190
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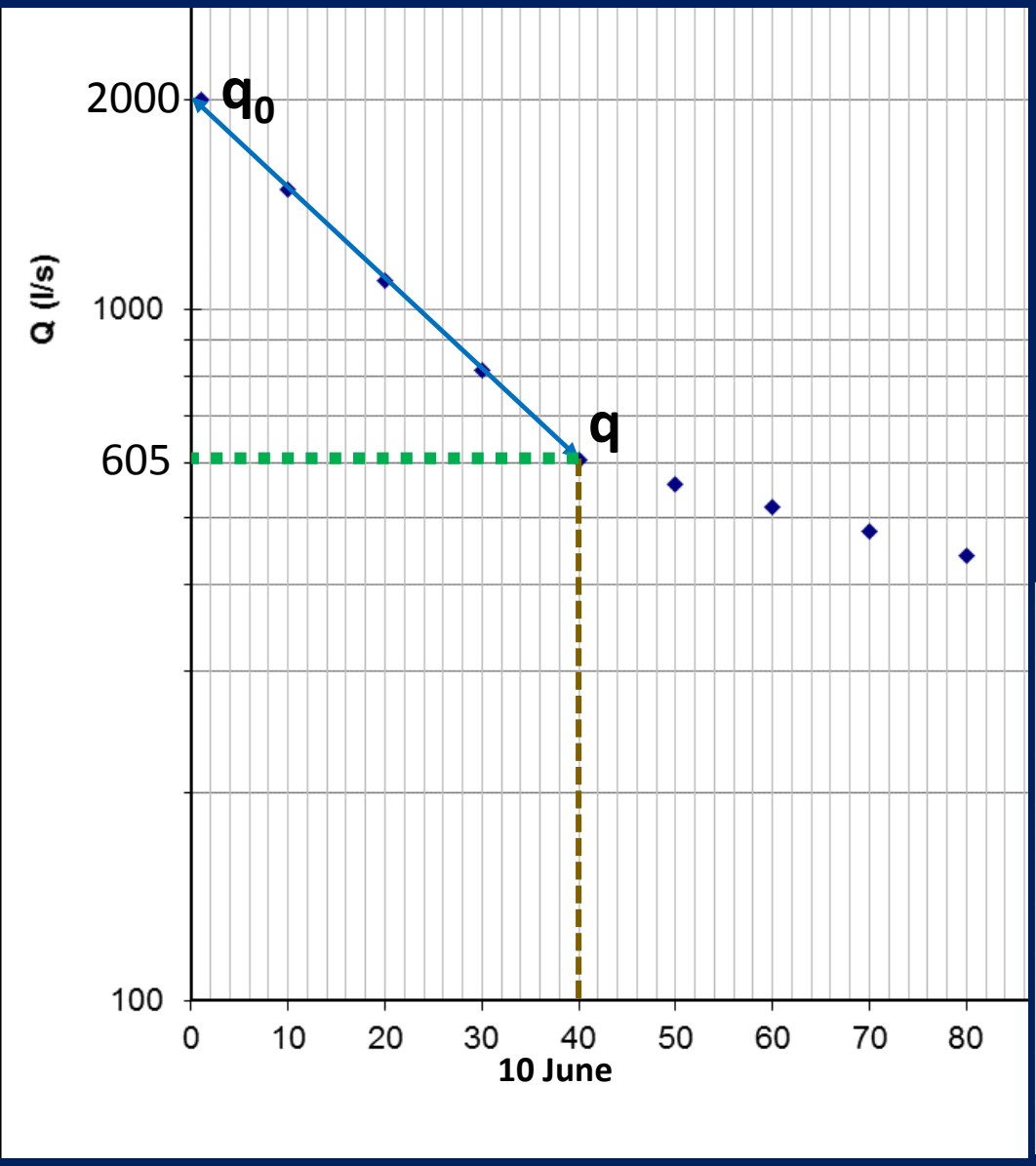
210
220
230
Zaman (gün)

$$q = q_0 e^{-\alpha(t-t_0)}$$

$\log q = \log q_0 - \alpha\, t \log e$

$\log 605 = \log 2000 - \alpha * 40 * 0.434$



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