READINGS / REFERENCES

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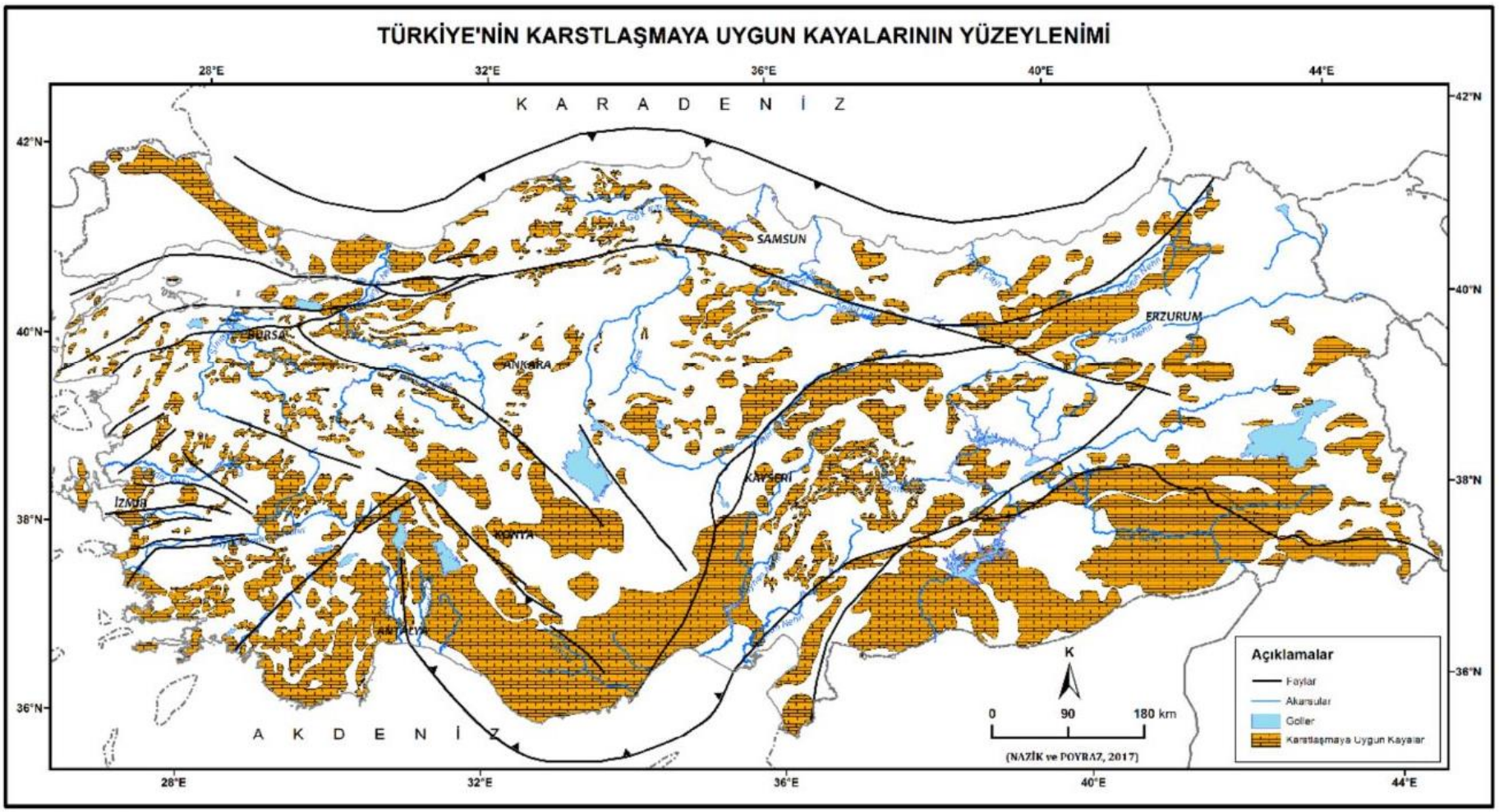
2. Öztürk, M.Z., Şimşek, M., Şener, M.F., Utlu, M. 2018. GIS based analysis of doline density on Taurus Mountains, Turkey. Environmental Earth Sciences, 77:536.
3. Nazik, L. ve Poyraz, M. 2017. Türkiye karst jeomorfolojisi genelini karakterize eden bir bölge: Orta Anadolu Platoları karst kuşağı. Türk Coğrafya Dergisi, 68, 43-56.

Course Contents

1. Introduction to Karst Geomorphology
2. Karst Rocks / Soluble Rocks and Karst Processes
3. Karst Hydrology, Karst Drainage System
4. Karst Landforms: Karren
5. **Karst Landforms: Doline (Sinkhole) and Blind valley**
6. Karst Landforms: Ponor, Sinkhole, Swallow hole, karst spring
7. Karst Landforms: Polje
8. Speleology, Caves, Speleothem
9. Gypsum Karst
10. Psödokarst, Termokarst (kryokarst)
11. Karst Hazards

Map of Soluble Rocks



Şekil 1. Türkiye'nin karstlaşmaya uygun kayalarının yüzeylenimi.
Figure 1. *Turkey's rocks suitable for karstification.*

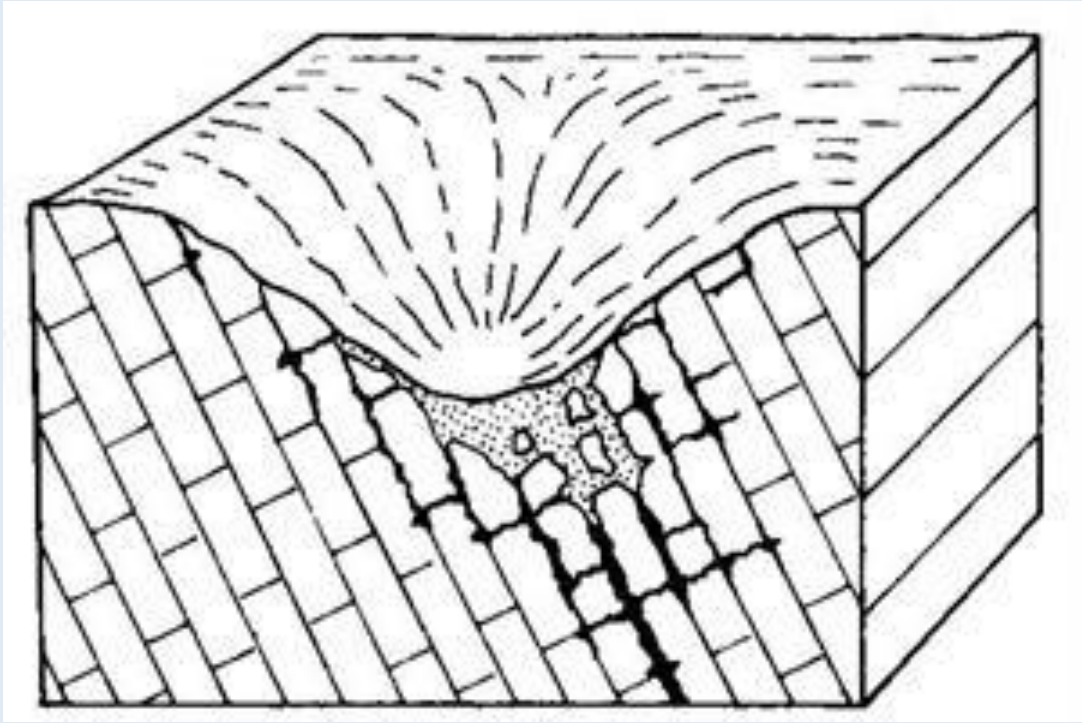
Nazik, L. ve Poyraz, M. 2017. Türkiye karst jeomorfolojisi genelini karakterize eden bir bölge: Orta Anadolu Platoları karst kuşağı. Türk Coğrafya Dergisi, 68, 43-56.

Closed Depressions

Doline : Slovene (dolina)

Sinkhole : English (USA literature)

Typically, dolines exhibit circular to subcircular shapes in plan form, with diameters ranging from a few meters to ~1 kilometer. Their sidewalls can range from gently sloping to nearly vertical, and depths may vary from a few meters to several hundred meters. Dolines are formed through processes such as dissolution, collapse, and subsidence, resulting in a range of features from shallow saucer-shaped depressions to deeper funnels and cylindrical pits. In the landscape, they may appear individually or clustered closely together.
A doline is a natural enclosed depression.



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Closed Depressions

1. Solution (Dissolution) Doline / Çözünme Dolini
2. Collapse Doline / Çökme Dolini
3. Caprock Doline / Örtü Kayası Çökme Dolini
4. Dropout Doline (Cover-Collapse Doline / Subsidence) / Örtü Çökme Dolini
5. Suffosion Doline / Alluvial Doline / Subsidence Doline / Alüvyal Dolin /
6. Buried Doline / Örtülmüş Dolin
7. Uvala
8. Polje

Subsidence

Dolines originate from four primary mechanisms:

- Dissolution
- Collapse
- Suffosion
- Subsidence

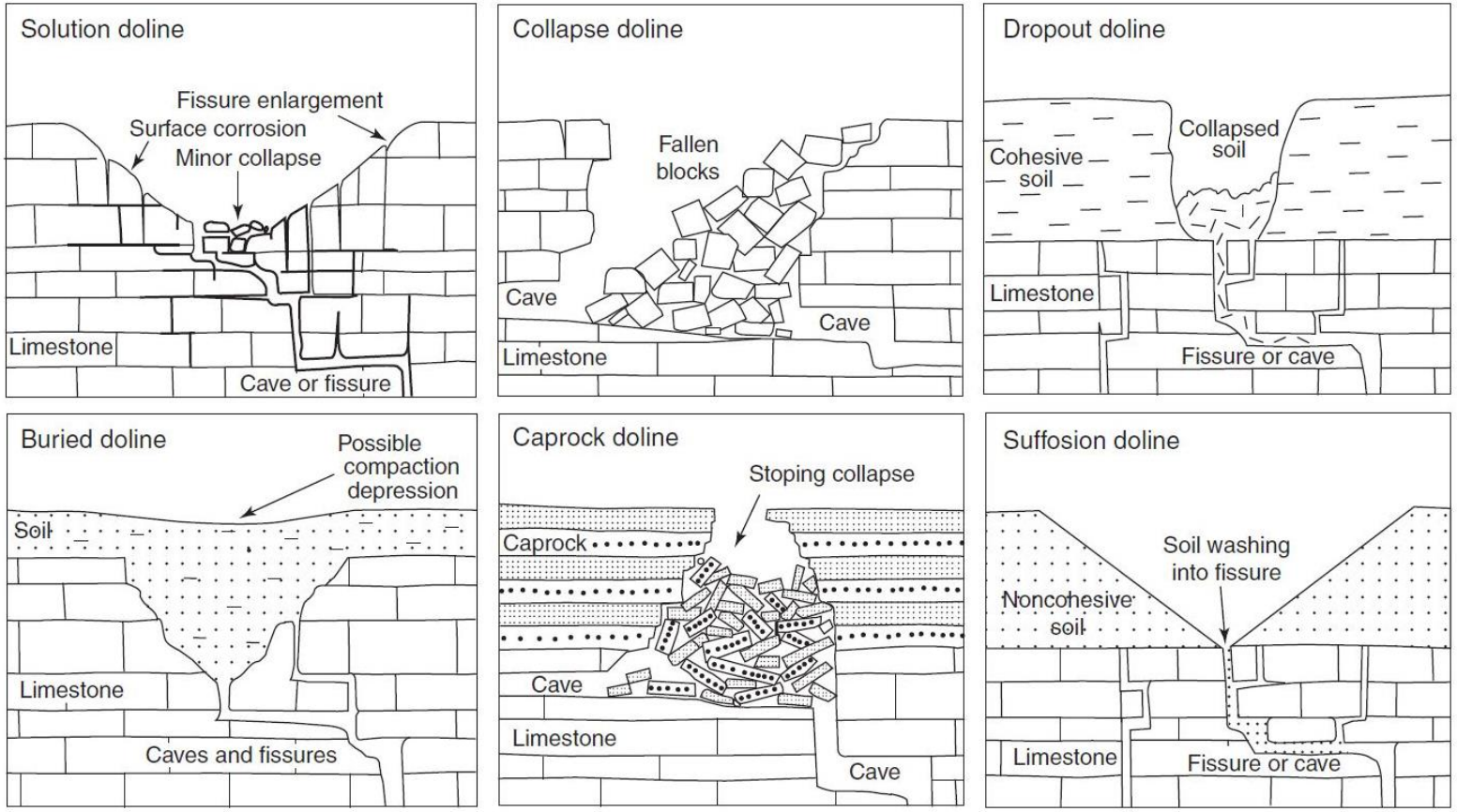


Figure 2 Six main types of dolines. Reproduced from Waltham, A.C., Fookes, P.G., 2003. Engineering classification of karst ground conditions. Quarterly Journal of Engineering Geology and Hydrogeology 36, 101–118.

Waltham, A.C., Fookes, P.G., 2003. Engineering classification of karst ground conditions. Quarterly Journal of Engineering Geology and Hydrogeology 36, 101–118.

Closed Depressions

1. Solution (Dissolution) Doline / Çözünme Dolini

The main process driving the formation and development of a solution doline is the dissolution or corrosion of the bedrock. The extent of rock removal through dissolution depends on the concentration of solutes and the volume of solvent, typically water draining through the doline.

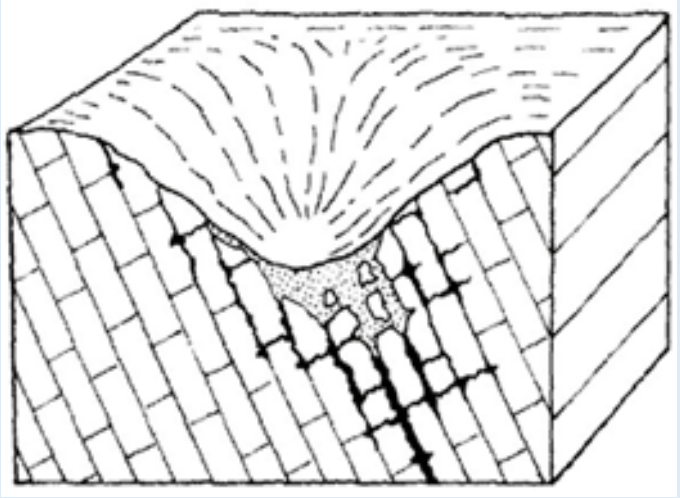
The formation of a doline relies on water's ability to infiltrate and flow through karst rocks towards outlet springs.

The most intense corrosion by atmospheric water typically occurs within the upper few meters of the limestone (epikarst or subcutaneous zone). Discontinuities such as joints, faults, and bedding planes serve as entry points for water into the rock. Regions with higher frequency of fissures tend to have more numerous and smaller dolines, while larger dolines are more common in massive, less fissured rocks, often indicating tectonic lines. In some areas, doline density can be exceptionally high, reaching hundreds or even thousands per square kilometer, particularly where dolines dominate the landscape.

Closed Depressions

1. Solution (Dissolution) Doline / Çözünme Dolini

Once a solution doline is established, positive feedback mechanisms promote its continued development due to the concentration of **water flow towards the center**, leading to increased dissolution. The aggressiveness of the water may be heightened by **elevated biogenic CO2 production** in the thick soils that tend to accumulate at the doline bottoms. Additionally, such **soils may retain moisture for longer** periods due to drainage accumulation and lingering snowmelt, potentially prolonging the duration of active dissolution. Furthermore, the enlargement of shafts through corrosion facilitates efficient vertical drainage, resulting in an increased **average water flow velocity** and enhanced mechanical transport of soil and rock particles washed downward, evacuating them underground. Enhanced vertical drainage also allows for greater leakage from the basin, thereby steepening the hydraulic gradient of the epikarst and promoting further drawdown in the subcutaneous water table. This, in turn, encourages the expansion of the influence radius of the centripetal drainage system.



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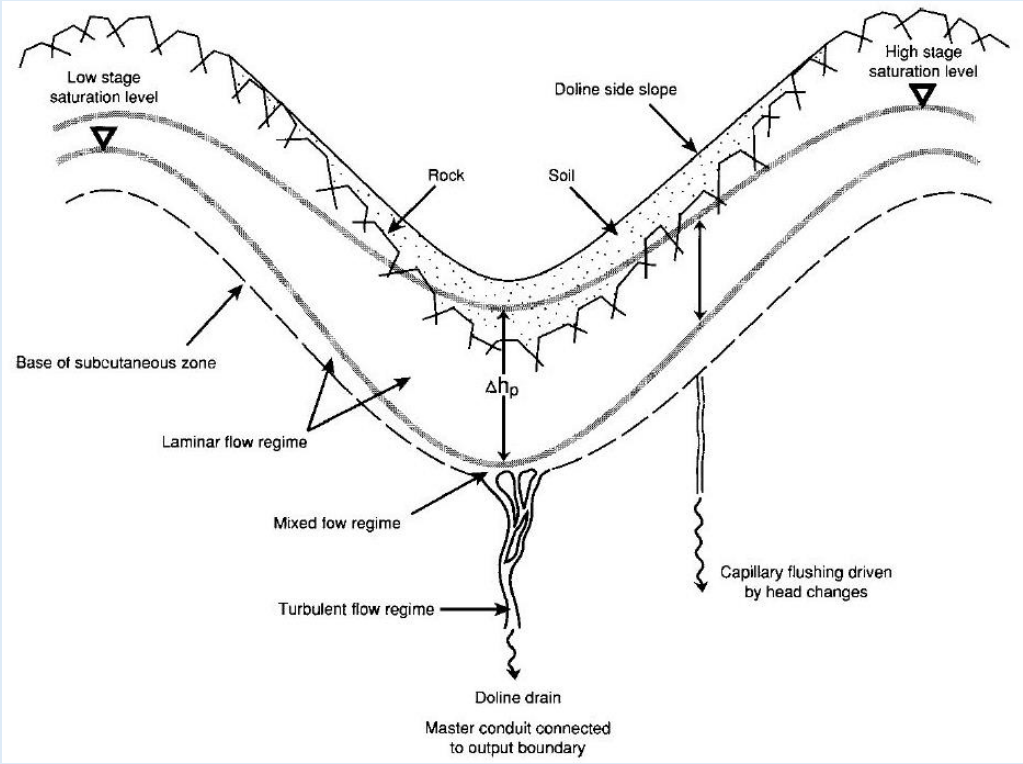

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Closed Depressions

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