Active tectonics of Spil Mountain, Western Anatolia: Implications from morphometric and paleoseismic studies

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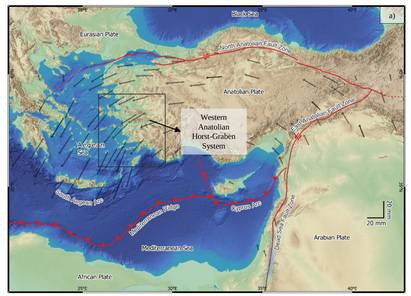
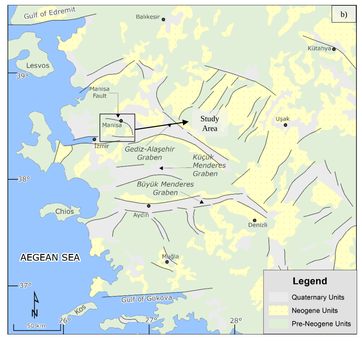
Introduction & Regional Geology

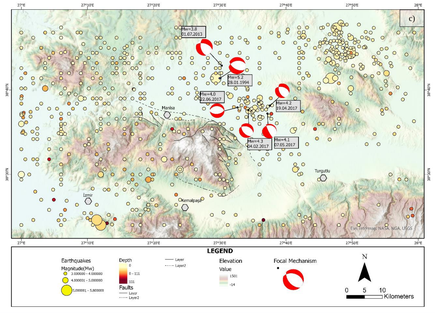


- Interactive display between plates including African and Arabian and active structures as dextral North Anatolian Fault Zone (NAFZ) sinistral East Anatolian Fault Zone (EAFZ) and Dead Sea Fault Zone (DAFZ) has controlled the active deformation through the Anatolian Plate (Fig. a).



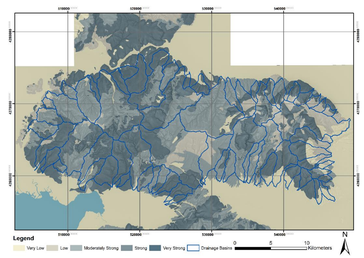
- The resultant deformation causes to form an extension controlled (NE-SW) province called Western Anatolian Horst Graben System. The grabens and intervening horsts are mostly NE-SW to E-W in direction (Fig. b).

- The study area which lays at SW part of Gediz-Alaşehir Graben that is delineated by E-W horst so called Spil Mountain and actively deforming Manisa Fault.

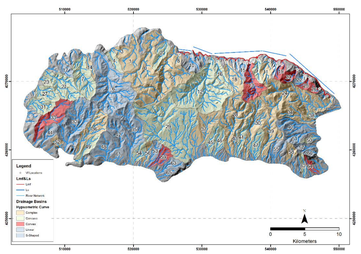


- The study area is showing earthquake activity (≈760 earthquakes $M_w \geq 3$) and resulting in the control of dynamic topography which makes it a good target for application of Morphometric Indices to understand active tectonics (Fig. c).

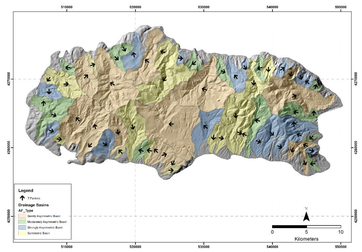
Morphometric Studies



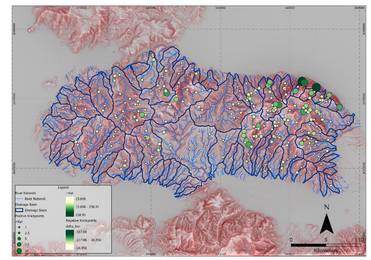
- The rock units existing at Spil Mountain resembles a uniform distribution of rock strength index (moderately strong to strong) from which the signals for applied morphometric indices expected to be coherent.



- Applied indices display Convex HC, low V_f and low S_{mf} implying young topography especially at the eastern part of Spil Mountain under the control of Manisa Fault.

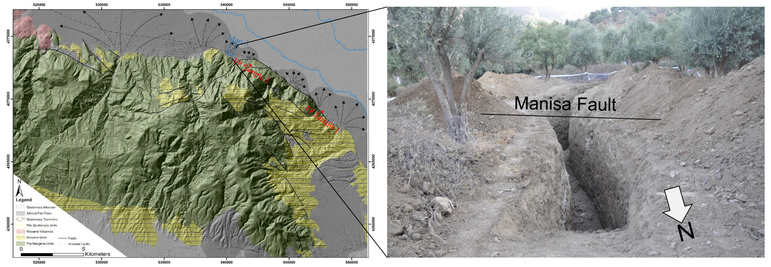


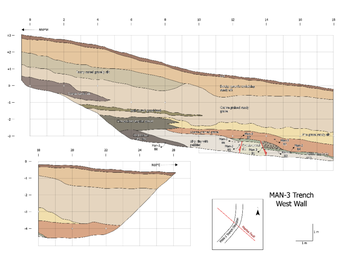
- Most of the drainage basin in the eastern part showing moderate to strong asymmetry in different directions which is related to existing normal faults in eastern part with different fault geometries and orientations.



- Especially positive and negative knickpoints along the river network existing in selected drainage basin are stacked and aligned around Manisa Fault representing very representative migration. However, rest of Spil Mountain is not showing any signal of tectonic control along longitudinal river profiles.

Paleoseismology Studies





- Through mapping of active faults are detected by 1:25000 mapping and accordingly 5 trenches are dug from which one of the trenches(Man-3) has displayed events. To constrain the timing of events, 8 bulk sediment samples are collected and dating processes is still ongoing.
- Moreover, fault plane dating is also another step that is ongoing. From two different fault planes 2 ages are obtained to achieve slip rate and differentiate the control of Manisa Fault both for Gediz-Alaşehir Graben and for regional scale.

Discussion

- The defined Manisa Fault in most of the previous studies is extending through mountain front meanwhile both by applied Morphometric Indices and Paleoseismology Studies, seems like Manisa Fault is affecting and controlling the topography only at eastern part where fault with its prominent features are existing.

- In order to improve this, aging of fault plane(more samples) and application of different indices (basin divide migration) to control the study area is the next step which is ongoing process.

Results

- Spil Mountain's rock units resist erosion equally to the north and south. The young topography has strong tilting in the eastern part, possibly linked to the Manisa Fault. Drainage migration is limited to the east, and upstream drainage areas near the fault have no significant steepening.
- Affect of earthquakes around Spil Mountain's eastern part, with two old records found in paleoseismology studies. These findings suggest that seismic activity played a role in the unique topography.
- Rest of the Spil Mountain might be reflecting the affect of regional tectonics rather than control of Manisa Fault.

Acknowledgements

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