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Integrating geochemical survey and magnetic prospection on an archaeological site in SW-Turkey

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In this study, geochemical and magnetic survey data from an archaeological site are combined, aiming to explore the potential of both techniques to complement each other. The site under study comprises a suburban area of 6 ha, situated in the Roman to Byzantine city of Sagalassos (Taurus Mountains, SW-Turkey). For the geochemical survey, a total of 120 soil samples were collected in two grids, with cell sizes of respectively 100 x 100 m and 20 x 20 m. After Aqua Regia destruction, Al, As, Ba, Ca, Cu, Co, Cr, Fe, K, Mn, Mg, Na, Ni, Pb, P, Sr, Ti, V and Zn were measured by inductively coupled plasma optical emission spectrometry (ICP-OES), using a Varian 720-ES apparatus. The magnetic survey was performed using a Geometrics G-858 magnetometer in gradient mode, along 0.5 m spaced transects.

Results indicate that large scale chemical prospection with cell sizes of 100 x 100 m is capable of detecting human influence on soils by anomalous values of Cu, K, P and Zn, although the data are too coarse to aid geophysical interpretation. In the more detailed grid with cell sizes of 20 x 20 m, geochemical enrichments of Co, Cr, Fe, Mg, Mn, Ni and V were detected on a location displaying strong magnetic anomalies. These anomalies were found to result from a local change towards a more mafic lithology. In an area where magnetic readings displayed high-frequency magnetic noise, soil samples contained distinct concentrations of P, Cu, K and Zn, suggesting that the soils at this location were strongly altered by human processes, which resulted in enhanced magnetic susceptibilities of the soils. An uphill zone, lacking the strongly contrasting magnetic anomalies found elsewhere, was shown to spatially correspond with enrichments of As, Al, Ba and Pb. The association of Al, Ba and Pb was identified as tracer signature for weathered limestone material in the territory of Sagalassos. Therefore, it is thought that the observed changes reflect the presence of a limestone hill in this zone. These results confirm the value of soil geochemistry as a tool in distinguishing anthropogenic from geological anomalies in the magnetic record.