



## **Cross-gradient joint inversion of gravity and aeromagnetic data in mineralized northern Menderes Massif, Turkey**

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The Menderes Massif in western Turkey formed by the stacking of tectonic units during Cretaceous-Eocene shortening that were modified by late Oligocene to recent crustal extension, accompanied by significant crustal melting. The interaction of regional deformation with crustal melting and the emplacement of plutons and volcanic complexes during both contraction and extension across structures related to the Tethyan suture has resulted in epithermal and porphyry type gold mineralization that has taken place mainly in the northern and western parts of the Menderes Massif, and in ongoing structurally controlled hydrothermal activity across its entire extent. The northern Menderes Massif contains granitic intrusions, ophiolitic klippen, volcanics, metamorphic basement and Cenozoic sediments. Some of the plutons, such as the Egrigöz granite, have intruded into the footwall of an extensional shear zone, defining at least part of the granite-intruded basement as a Miocene metamorphic core complex with ophiolitic rocks of the Vardar-Izmir-Ankara zone in the hanging wall plate.

Here we present results of cross-gradient joint inversions of gravity and magnetic data in the northern Menderes Massif along a series of cross-sections oriented N-S, E-W and ESE-WNW. The inversions were carried out to better define the subsurface geology and aid targeting hydrothermal mineralization.

The results suggest that metamorphic rocks with low magnetization underlie wide areas in the centre and east of the study area. Dense rocks with low to intermediate magnetization often correlate with oceanic affinity rocks that extend to great depth in the west and southeast of the study area, but occur as thin sheets in the centre. Regions of low to intermediate magnetization and low density are mostly encountered with the upper 5 km of the crust and are often spatially associated with felsic volcanic complexes and sedimentary rocks. High magnetization and low density are generally associated with granitoid intrusions, and mainly occur in the west, north and southeast of the study area, where they locally extend to the base of the cross section at 10 km depth.

The inversions allow tracing the tectonic boundary between the Menderes Massif and overlying accreted subduction complex rocks: crustal provinces with oceanic affinity occur predominantly in the west and the southeast of the sections. The Bornova flysch, and the Tavsanli and Afyon zones occur in thin sheets in the centre / east and make up the entire studied depth of the crust in the west. The boundary is a steep structure in the west, and a shallowly dipping structure in the centre of the area, where the Menderes basement is at shallow levels. Where the structure is shallow, the boundary is likely to be an extensional detachment fault.

Metamorphic rocks, but more so ophiolitic rocks in the OC terrain are potential reductants for magmatic and hydrothermal fluids sourced from, or in equilibrium with felsic-intermediate volcanics and intrusions. The key control to mineralisation may be with which type of wall rock Miocene intrusions and volcanic complexes have interacted. Given that the subduction complexes consist to a large extent of ultramafic and meta-carbonate rocks, it is not surprising that most mineral occurrences are in oceanic affinity crust, which is more prospective because of (i) its potential to reduce magmatic fluids, (ii) its mechanical inhomogeneity which translates into a better potential to dilate under stress thus providing pathways to fluids and melts, and (iii) its position as the 'hanging wall trap' unit in the steep western zone and the shallow detachments in the central study area.