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An aspect of the subsurface structure of the Burdur-Isparta area, SW Anatolia, based on gravity and aeromagnetic data, and some tectonic implications

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Gravity and aeromagnetic analyses were conducted in the Burdur-Isparta area of Turkey in order to identify the subsurface structure and tectonics of the region independent of surface cover. The analytic signal of the aeromagnetic anomalies was first calculated to delineate the source fields of these anomalies. The magnetic signatures were found to correlate well with the intrusives associated with the subduction of the African oceanic lithosphere and with the ophiolitic nappes in the region. The residual aeromagnetic anomalies mostly orientate in the N-S direction, implying the presence of remanent magnetization. Based on the shape analysis of aeromagnetic anomalies, the region appears to have rotated clockwise. The magnetic anomalies were found to continue upward to 5 km a.s.l. The upward continued map shows deep effects of the sub-crustal magnetic sources. Based on the Bouguer gravity anomalies, the thickness of the crust in the study area is between 33 and 37.5 km. Major extensive NE- and NW- as well as N-trending faults are identified that coincide with the Lake Burdur, Lake Beysehir and Kovada grabens, respectively. Lake Egirdir is also devoid of any magnetic sources. As a final step, the maxima of the horizontal gradient of the gravity data were calculated. The maxima show that the major geological formations and the structural trends in the area are remarkable. The boundaries of the various geological formations can be identified based on the boundary analysis of the gravity and the analytic signal of the aeromagnetic data. The change in the nature of the anomalies reflects the imprints of intense deformation associated with major tectonic activity of the African-Eurasian plate convergence zone.

Key words: Gravity anomalies, aeromagnetic anomalies, the Burdur-Isparta area, analytic signal.

1. Introduction

The study area is located in Isparta Province, SW Anatolia, Turkey, which is situated at the boundary between the rapidly extending West Anatolian Extensional Province (WAEP) and the relatively stable Anatolian plateau (CAOP; Fig. 1). The main structural feature of SW Anatolia is the Isparta Angle, which is situated at the intersection of the Hellenic and Cyprus arcs (Blumenthal 1963). The nature of the junction between the Hellenic and Cyprus arcs and its tectonic relation with the Isparta Angle is still a matter of debate (see Barka *et al.*, 1995; Glover and Robertson, 1998; Yagmurlu *et al.*, 1997). In this study, we used gravity and aeromagnetic data to investigate the structure of SW Anatolia.

The analysis of potential field (gravity-magnetic) data provides insight into a wide scale of structural trends, the position of faults, and the distribution of structures of differing densities and magnetizations. Gravity and aeromagnetic data on the entirety of Turkey were collected by the General Directorate of Mineral Research and Exploration of Turkey (MTA). The observed gravity data, collected at 2- to 5-km intervals, were applied by the MTA in the following corrections: (1) latitude corrections; (2) Bouguer corrections assuming a density of 2.40 Mgm^{-3}; (3) topographic corrections; (4) free-air and tidal corrections. Aeromagnetic data were collected spanning the period of 1978–1989 along flight lines spaced at intervals of 1–5 km at an elevation of 600 m above ground level (Ates *et al.*, 1999). Ates *et al.* (1999) have published the Bouguer gravity and aeromagnetic (total intensity) anomaly maps of Turkey in degree sheet format as the relevant corrections were applied.

Gravity anomalies may originate anywhere within the Earth, but the source of magnetic anomalies is limited by the Curie point isotherm depth (Pollack and Chapman, 1977). Thus, magnetic anomalies are limited to sources within the crust, while gravity anomalies have origins which may reach several hundred kilometers or more into the mantle. Based on spectrum analyses of aeromagnetic data, the Curie point depth (CPD) estimates for this region range between approximately 13 and 19 km (Dolmaz *et al.*, 2005), implying that there are no magnetic sources below these depths. We have integrated aeromagnetic and gravity data in the Burdur-Isparta area with the objective of identifying possible subsurface structures and magnetic sources in the study region independent of surface cover. The results from such an investigation on the potential field anomalies in this seismically active region would contribute to a better understanding of the tectonics of SW Anatolia. Tectonic, magnetic, and gravity considerations are discussed, and the results are illustrated using several techniques.

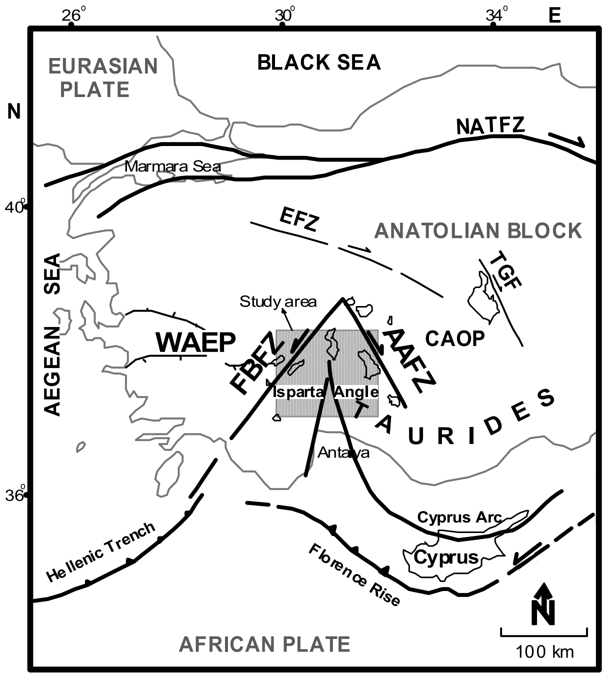

Fig. 1. Simplified tectonic map of west Turkey and adjoining regions. The centrally shadowed area indicates the study area, structural details of which are given in Fig. 2. Abbreviations: NATFZ, North Anatolian Transform Fault Zone; FBFZ, Fethiye-Burdur Fault Zone; AAFZ, Afyon-Aksehir Fault Zone; EFZ, Eskişehir Fault Zone; TGF, Tuz Gölü Fault; WAEP, West Anatolian Extensional Province; CAOP, Central Anatolian Ova Province. Coastlines and lakes are also shown.

2. Regional Tectonic Setting

The Burdur-Isparta area is located in a rather remarkable tectonic setting (Figs. 1 and 2), both near the northern part of the Isparta Angle and at the northeastern extremity of the Fethiye-Burdur Fault Zone (FBFZ). Figure 2, which is compiled from Yagmurlu *et al.* (1997), presents the main geological and tectonic information currently available on the region under study. This tectonic region is related to the westward motion of the Anatolian Plate towards the Aegean region (Taymaz *et al.*, 1991; McClusky *et al.*, 2000), which is bordered by the active margins of the Hellenic and Cyprus arcs, where the oceanic crust of the African Plate is being subducted towards the north. Furthermore, this area is placed at the western end of the Taurus Mountains of southern Turkey and marks a seismically active part of the broad transition zone between the African and Eurasian plates.

The Burdur-Isparta area, which is part of the N- to S-trending right lateral Isparta Angle suture zone, separates the WAEP from the Anatolian Plateau (Glower and Robertson, 1998). The western edge of the Isparta Angle consists of the FBFZ; the FBFZ is considered to be the northeastern continuation of the Pliny-Strabo trench that links the Isparta Angle with the Hellenic Arc (Fig. 1; Barka *et al.*, 1995; Glover and Robertson, 1998). Clockwise rotation of faulted blocks within this right lateral shear zone generated NE- to SW-trending left lateral faults (Price and Scott, 1994). The Bouguer gravity and aeromagnetic data given here originate mainly from internal parts of the Isparta Angle area. Several earlier tectonic studies have been carried out for different purposes in the study area (see Kocyigit, 1984; Marcoux *et al.*, 1989; Paton, 1992; Taymaz and Price, 1992; Robertson *et al.*, 1996; Yagmurlu *et al.*, 1997; Alıcı *et al.*, 1998; Savascin and Oyman, 1998; Francalanci *et al.*, 2000; Cengiz *et al.*, 2001, 2006; Tatar *et al.*, 2002).

The Isparta Angle, the most important regional tectonic structure of SW Anatolia, was formed by the clockwise rotation of the western side and counter-clockwise rotation of the eastern side during the Neotectonic period (Robertson *et al.*, 1996). The Isparta Angle is separated by the N-trending Egirdir-Kovada graben into two regions: mainly NE-trending fault systems are dominant in the western part, while the NW-trending lineaments and folds are predominant in the eastern part (Fig. 2; Cengiz *et al.*, 2006). The Isparta Angle graben system (N-S trending) is part of the back-arc extensional basins that developed in the hanging-wall of the African-Eurasia plate boundary. Thus, normal faulting dominates in the Isparta Angle region (Glover and Robertson, 1998). Based on data on historical and recent events, the Burdur Fault is considered to be still seismically active (Sintubin *et al.*, 2003) and well defined by weak to moderate earthquakes. Major earthquakes are associated with large faults that break through the entire thickness of the seismogenic crust and cause surface ruptures exceeding several tens of kilometers (Stiros, 2001). The Burdur area is situated in a zone of significant weak to moderate seismic activity. The Burdur Quaternary Basin is also characterized by the NE- to SW-trending half-graben, bounded to the southeast by major NW-dipping, slightly listric basement faults (Fig. 2; Taymaz and Price, 1992; Price and Scott, 1994). To the northeast, this graben terminates against the NW- to SE-trending Dinar fault. The fault plane solutions of both the 1971 Burdur and the 1995 Dinar earthquakes indicate pure normal faulting (Barka *et al.*, 1995; Eyidogan and Barka, 1996; Pınar, 1998).

The Isparta Angle suture zone is situated between the Aegean crust (22–32 km thick) and the Anatolian crust (40–50 km thick) (Price and Scott 1994; Saunders *et al.*, 1998). From inversion of the magnetotelluric data of a NW-SE profile in SW Anatolia under the Taurus Mountains, a very highly resistive ($>2000\ \Omega$m) thicker (approx. 40 km) upper crust is observed, while the lower crust is much thinner (Gurer *et al.*, 2004).

3. Geophysical Data

The gravity and aeromagnetic data were provided by the MTA, and the International Geomagnetic Reference Field (IGRF) for the 1982.5 was then removed from the aeromagnetic anomalies using the program of Malin and Barraclough (1981). Afterwards, the data were interpolated to a square grid with a spacing of 2.5 km. The total magnetic field data first were transformed into the magnetic pole (Baranov, 1957), producing a magnetic map where the highs are located more directly on their causative source and lows are suppressed or eliminated. The total field aeromagnetic data were then reduced to the (north) magnetic pole utilizing the FFTFIL program (Hildenbrand, 1983) and contoured to produce the magnetic anomaly map shown in Fig. 3, which shows several anomalies. Strong positive anomaly zones are clearly visible around Isparta, Keciborlu, and the Sarkikaraagac area. These zones contain both the

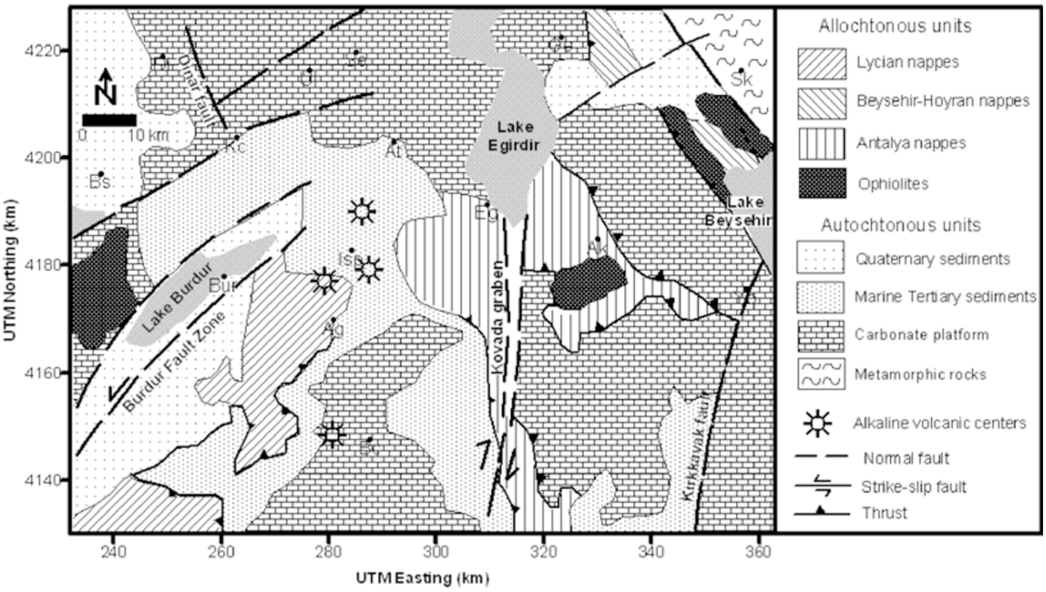

Fig. 2. Simplified structural map of the Burdur-Isparta area (modified from Yagmurlu *et al.*, 1997). Isp, Isparta; Bur, Burdur; Di, Dinar; Ak, Aksu; Bs, Basmakci; Ag, Aglasun; Kc, Keciborlu; Bc, Bucak; At, Atabey; Eg, Egirdir, Ge, Gelendost; Ul, Uluborlu; Se, Senirkent; Sk, Sarkikaraagac; Yb, Yenisarbademli.

greatest amplitudes and highest frequencies. Another set of weak anomalies is concentrated around in the south of Aksu, inside of the Burdur basin, and in the Kovada graben. Ates *et al.* (1997) implied that comparable magmatic bodies have existed within an extensional province associated with grabens in SW Turkey. Due to the changing inclination of the geomagnetic field in the study region, it is difficult to identify the sources directly from the anomalies.

4. Analysis and Interpretation

To investigate the regional crustal structure over the Burdur-Isparta area, we prepared various anomaly maps based on gravity and aeromagnetic anomalies. In order to simplify the description, we computed the analytic signal from the magnetic anomalies. The amplitude function of the analytic signal is defined as the square root of the squared sum of the vertical and two horizontal derivatives of the magnetic field anomaly (Roest *et al.*, 1992; Roest and Pilkington, 1993; Salem *et al.*, 2002).

$$|A(x, y)| = \sqrt{\left(\frac{\partial M}{\partial x}\right)^2 + \left(\frac{\partial M}{\partial y}\right)^2 + \left(\frac{\partial M}{\partial z}\right)^2}. \quad (1)$$

where $|A(x, y)|$ and M are the amplitudes of the analytic signal and the magnetic anomaly field intensity, respectively. The analytic signal method has been used extensively in magnetic interpretation (e.g., Nabighan, 1972; Roest *et al.*, 1992; Mohan and Babu, 1995; Hsu *et al.*, 1998; Harikumar *et al.*, 2000; Bastani and Pedersen, 2001; Salem *et al.*, 2002; Anand and Rajaram, 2003, 2004; Keating and Sailhac, 2004). This signal exhibits maxima over magnetization contrasts, independent of the ambient magnetic field and source magnetization directions. Thus, the locations of these maxima determine the outlines of the magnetic sources (Roest *et al.*, 1992; MacLeod *et al.*, 1993). The analytical signal of the total magnetic field reduces the magnetic data to anomalies whose maxima mark the edges of

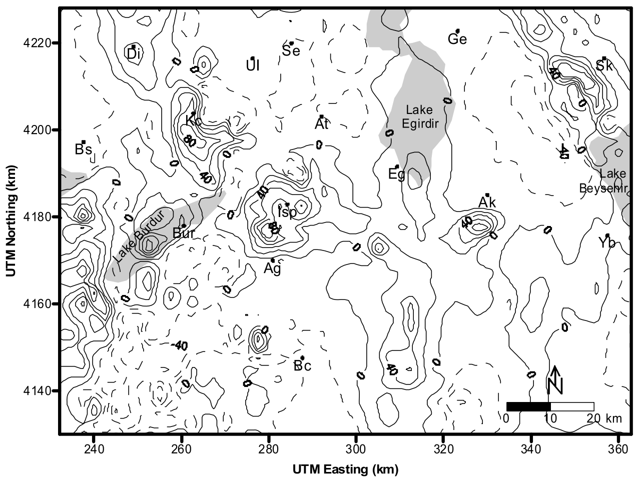

Fig. 3. Reduced to pole total field aeromagnetic anomaly map of the study area. Contour interval is 20 nT. Continuous lines denote positive values, whereas dotted lines denote negative values. Place name abbreviations are as in Fig. 2.

the magnetized bodies. Moreover, the analytic signal can be used to outline magnetic contrasts and their approximate depths, and it is possible to determine the signature of the causative body of the magnetic anomaly from the exact shape of the analytic signal (Roest *et al.*, 1992). At low latitudes, an extensive source body will have a stronger analytical signal at their north and south edges (Harikumar *et al.*, 2000; Anand and Rajaram, 2003, 2004).

In order to understand the distribution of magnetic sources in the study region, the analytical signal of the aeromagnetic anomalies were computed based on the above procedure (Fig. 4). The application of this technique to the aeromagnetic data of the Burdur-Isparta area revealed that some highly magnetized bodies are the main sources of high magnetic anomalies. The analytic signal highlights

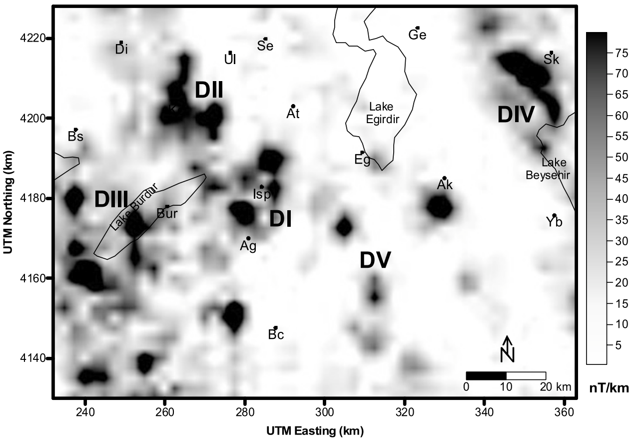

Fig. 4. Analytic signal of aeromagnetic anomaly over the study area. Maxima (highs) are located over the magnetic sources. For clarification of labels, see text.

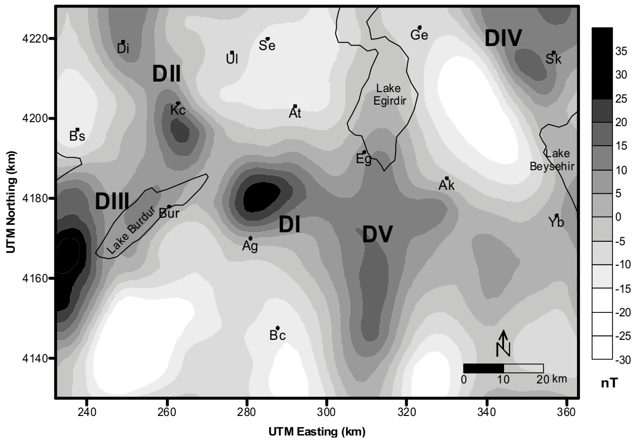

Fig. 5. Total field anomaly upward continued to 5 km above sea level. See Fig. 2 for clarification of place name abbreviations.

three circular features beneath the Isparta area (DI) that has been identified as the Golcuk Crater Lake district. The map clearly brings out the magnetic sources associated with volcanic compositions of the Pliocene Golcuk volcanism. Basic and evolved dikes are represented by short wavelength and high-amplitude anomalies. The important volcanic occurrences, such as caldera, volcanic cones, and circular and elliptical structures, have been identified on satellite image analysis in the Golcuk Crater. Volcanic cones and lava flows showing elliptic and circular structures are generally composed of rocks with trachyandesitic and andesitic compositions (Cengiz *et al.*, 2006). The analytic signal map, Fig. 4, also highlights an L-shaped feature beneath the Keciborlu area (DII). The marine Tertiary sediments on the Carbonate Platform are correlated with this magnetic feature (Fig. 2). However, it is difficult to assess its cause. There may be an underground magnetized body underneath the alluvial cover, and if this is the case, the magnetic anomalies of this feature may be caused by induced magnetization due to a susceptibility increase, as suggested by Kiss *et al.* (2005). The analytic signal becomes more complex in magnetized bodies, in extended sources within the subsurface, in DIII underneath the alluvial cover of the Burdur graben, and in the surrounding area (Figs. 2 and 4). This region shows broader anomalies. These magnetization highs might be caused by an ophiolitic structure in the west of the Lake Burdur region based on outcrop geology (Fig. 2). It is noteworthy that a very high NW-SE elongated anomaly is noted in DIV which correlates well with the Beysehir-Hoyran ophiolite nappes emplaced onto the Metamorphic rocks (Figs. 2 and 4). The map illustrates a highly magnetized body characterized by being approximately 20 km long in the NW-SE direction. Its pattern seems to be related to an inverse magnetized source. Lake Egirdir is also devoid of any magnetic sources for correlation. Consequently, the analytic signal map of aeromagnetic anomalies shows a typical signature associated with volcanic areas which is observed—or not—on the surface geological map.

The reduced pole aeromagnetic data contain both long wavelength and short wavelength anomalies. Various transformations are carried out to isolate the sources responsible for the compounding of long and short wavelength anomalies of varying amplitudes (Blakely, 1995). To minimize the effects of local topography and isolate deep source effects, the data were subjected to upward continuation. Figure 5 displays the total field magnetic anomalies continued upwardly to 5 km above mean sea level. This map presents a reasonable correlation with the Bouguer gravity map of the study area (Fig. 6). A very striking feature of the upward continued map is the appearance of the NW-SE (DII) and NE-SW highs (DIII) in the west, the NW-SE high in the east (DIV), and the N-S high (DV) cutting across them from north to south. A NE-SW positive magnetic anomaly in the Burdur Basin may be associated with the fault plane of the Burdur Basin (DIII). The continuation of these anomalies within the Burdur Basin provides complementary information about the location of the Burdur faults. Magnetic anomaly highlights on the BFZ (Fig. 4) can be interpreted as being highly magnetized, dike-like bodies elongated parallel to fault line. Magnetic anomalies on the North Anatolian Fault (NAF) branch running through the southern coast of Lake Iznik of the Marmara region can be also interpreted in terms of highly magnetized, two-dimensional dike-like bodies elongated parallel to the fault line (Tuncer *et al.*, 1991).

The NW-SE faults (DII and DIV), the NE-SW faults (DIII), and the N-S faults (DV) are deeper, as evidenced from the upward continued map (Fig. 5). The upward continued map shows NE trends in the Burdur basin (DIII), while the regions of Sarkikaragac (DIV) and Dinar (DII) are characterized by NW-SE trends. From this it can be inferred that there is no change in the crustal structure in deeper levels in DII and DIV, while in DIII the trends change from N-S at a shallow level to NE-SW in the deeper levels, and there is no significant indication on the analytic signal map of N-S deeper effects at deeper levels in DV. In DI, the upward continued map (Fig. 5) shows large elliptical positive anomaly closure in the Golcuk crater region (Isparta), suggesting the presence of intrusion underneath. The upward continued map shows clearly the Golcuk volcanic district in the Isparta area, and from this it can be inferred that there is a huge intrusion in the crust at deeper levels. The up-

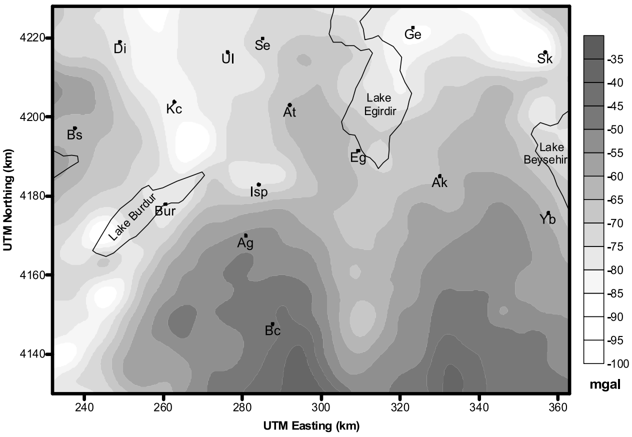

Fig. 6. Bouguer gravity anomaly map of the study area. See Fig. 2 for clarification of place name abbreviations.

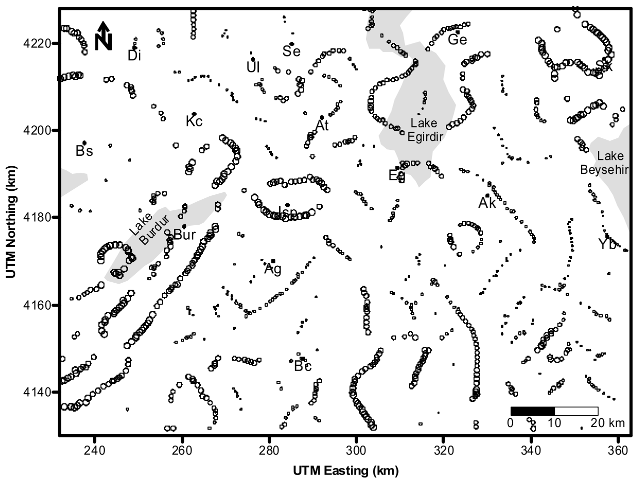

Fig. 7. Locations of the maxima of the horizontal gradient of gravity anomalies. Sizes of the circles are proportional to the magnitudes of the gradients. See Fig. 2 for clarification of place name abbreviations.

ward continued map (Fig. 5) also shows a large elliptical positive anomaly closure (approx. 10 km in radius) in this region (DI), suggesting that the presence of Golcuk volcanism is larger underneath than the surface appearance. Moreover, mineralizations, such as S, As, Pb-Zn, and raw material ignimbrite, which are associated with Golcuk volcanism in around the Isparta area, could be source of magnetic anomalies. In the southwest of Aksu, a circular body having a radius of approximately 4 km shows Kizildag ophiolite (Fig. 4; Dolmaz *et al.*, 2002). In the west of Bucak, an analytic high signal, corresponding to the presence of a volcanic source, is observed, whereas the upward continued map does not show this effect at deeper depths. Therefore, we conclude that the volcanic source apparent in the surface geology in this area is not present at the deeper levels of the upper crust.

The NW-SE and NE-SW trends in the west, the NW-SE trends in the east, and the N-S trends in the center of the study area (Fig. 5), all associated with fault planes, suggest that observed linearity of many magnetic features in the study area formed from brittle fracturing of the crust, as suggested by Anand and Rajaram (2004).

The Bouguer anomaly map (Fig. 6), which reflects a high gradient area, generally shows NE-SW, NW-SE, and N-S trends in the study region. In the regional gravity picture (Fig. 6), the NE-SW trend in the Burdur Basin is found to extend further north and abuts against the Kovada and Sarkikararagac-Beysehir graben systems. When extended southeastwards, the trend joins with the Kovada graben, implying that the N- to S-trending rift valley runs from Lake Egirdir to the south coast, which formed a rupture in the crust contiguous towards the ocean continent boundary. Mesozoic sediments are characterized by low-gravity gradients with very few anomaly closures. The alluvium, flysch, limestone, and sandstone of the Burdur basin show broad wavelength gravity anomalies that reflect the basement. The NNE-trending BFZ coincides with the high amplitude anomalies. The thermal structure of the crust across the complex deformation zones in SW Turkey has been examined using the CPD estimates from aeromagnetic data, and the thermal state of the crust has been compared with the seismic activity to provide insights for spatial limits of brittle failure (Dolmaz *et al.*, 2005). While the weak heat flow anomalies (40–80 mWm^2) are observed in the Burdur-Isparta region, the higher heat flow anomalies (80–160 mWm^2) are observed to the north of that region and termed the Usak-Afyon thermal anomaly zone. The southern edge of the Usak-Afyon thermal zone has been damaged repeatedly by large earthquakes (the earthquakes around the cities of Dinar and Burdur), and there is a trend for large earthquakes to concentrate in the areas corresponding to the boundaries between high and low thermal regions of the crust. Dense earthquakes in the Antalya region of the SW Anatolia are of deep origin and thought to be associated with the northward subduction of the African plate (Dolmaz *et al.*, 2005). Thus, the study area affected by the subducting slab is characterized by low thermal regions.

A two-stage method for analyzing gravity or pseudo-gravity anomalies was introduced by Blakely and Simpson (1986) and is as follows: (1) calculation of the horizontal gradient anomalies of gravity anomalies, and (2) estimation of the position of the edges of bodies producing the gravity anomalies. In order to calculate the maxima of the horizontal gradient, the steps above have been applied to the gravity anomalies. Figure 7 shows, as circles, the locations of the maxima of the horizontal gradient of the gravity field; the size of the circles is proportional to the magnitude of the gravity gradient. This technique emphasizes the margins of the anomalous bodies present. In the west of the study area (DIII, south of Lake Burdur), the maxima imply NE- to SW-trending fault-structures (defined by the largest sized circles), with lengths of approximately 70 km. The NNE-orienting faults and fractures within the Burdur basin are clearly brought out in this map. Over the Isparta area, the edges of the causative body describe an ellipsoid elongated E-W (defined by the largest-sized circles), with dimensions of approximately 16 km E-W and approximately 10 km N-S (Fig. 7). This anomaly has a bowl-shaped, low-density structure and may be caused by tuffs in and around the Golcuk crater region. The smaller circles may originate from

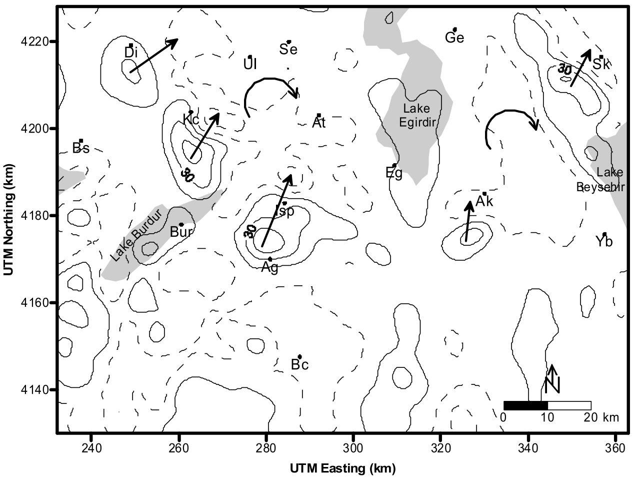

Fig. 8. Residual aeromagnetic anomaly map of the study area. Contour interval is 20 nT. Continuous lines denote positive values, whereas dotted lines denote negative values. See Fig. 2 for clarification of place name abbreviations. Solid arrows show clockwise rotations.

smaller gravity features or edges of some geological formations.

In order to identify the remanent magnetization direction, the shape of the magnetic anomalies can be interpreted (Ziets and Henderson, 1956). The residual aeromagnetic anomaly map of the study area (Fig. 8) is dominated by a few isolated anomalies, mostly oriented in the N-S direction; these imply the presence of remanent magnetization. The anomalies of the region generally display a clockwise rotation (Fig. 8). In the study area, most of the anomalies have a positive peak in the south and a smaller negative peak in the north, thereby resembling the nature of the northern hemisphere. Hence, it can be suggested that the magnetized bodies in the study area gained their magnetization during a normal polarity time.

We use here the Bouguer anomaly map to determine the thickness of the crust (Riad *et al.*, 1981). The relation with the average gravity and the thickness of the crust is given by Riad *et al.* (1981):

$$H = 29.98 - 0.075\Delta g \quad (2)$$

where Δg is the Bouguer anomaly values in mgal and H is the thickness of the crust in kilometers. Most of the studies including crustal models in recent years have been made using deep seismic sounding (DSS) data (e.g., Arita *et al.*, 1998; Grabowska *et al.*, 1998; Ergun *et al.*, 2005; d'Acremont *et al.*, 2006). Even though we do not have DSS data, we do attempt to define the interval values of the crust in the study area. In approximate terms, we suggest, based on the Bouguer gravity data, the presence of an anomalous dense, thicker crust varying between 33 and 37.5 km in thickness in the study area. The thickness of the crust was also found to be approximately 36 km based on Bouguer gravity data from southern Turkey (Riad *et al.*, 1981). Inversion of the magnetotelluric data across the Taurides of SW Anatolia provided an invaluable insight into the variations in depth of the transition from resistive upper crust to conductive lower crust (Gurer *et al.*, 2004). The southern part is characterized by a thick (approx. 40 km) resistive (> 2000 Ωm) upper crust and a thin conductive lower crust. The crustal structure beneath the Isparta seismograph station is estimated to be 31±1 km, based on the receiver function method (Kalyoncuoglu and Ozer, 2003), which is slightly lower than our estimates. The crustal model of Kalyoncuoglu and Ozer (2003) consists of three distinct layers: (1) the surface layer, which is approximately 2 km thick, with an S-wave velocity of approximately 2 km/s; (2) the second layer, which is approximately 15 km thick, with an S-wave velocity of approximately 3.35 km/s; (3) the third layer, which is approximately 14 km thick, with an S-wave velocity of approximately 3.8 km/s (Kalyoncuoglu and Ozer, 2003). In the Golcuk area (DI, Isparta), negative gravity and positive magnetic anomaly correlation appear to be related to the regions of thicker crust and high magnetization. Regional North American gravity and magnetic anomaly correlations reveal that the regions of large relative crustal thickness and high magnetization are characterized by negative gravity and positive magnetic anomalies (von Frese *et al.*, 1982). The gravity and magnetic anomaly trends are in conformity with the known structural trends of the region. All of this evidence suggests that the structural features of the study area might be shaped by intense deformation associated with major tectonic activity.

5. Conclusion

An examination of the total magnetic field and gravity data and their transformations show that in SW Anatolia there are two main lines of faulting of the basement rocks; these are almost at right angles to each other, with NE-SW and NW-SE trends, respectively, and represent deeper features. A N- to S-trending fault cuts through them. The major NE faults running close and parallel to Lake Burdur and appear to have controlled the sedimentation pattern along the FBFZ. The NW-trending faults also run close to Lake Beysehir. The N-trending fault components, which are parallel to the Kovada Graben have been observed in the eastern and western parts of the graben from an analysis of potential field data. Shape analysis of the selected anomalous regions of the aeromagnetic anomaly map of the Burdur-Isparta area in SW Anatolia indicated that the region generally rotated clockwise. We were able to detect dipolar shape anomalies that show an induced field shape, which meant that remanence was acquired during a period of normal polarity of the Earth's magnetic field.

The Bouguer anomaly map generally shows contours elongated in NE-SW and NW-SE directions in the west and in the NW-SE direction in the east of the study area, which are in good agreement with the aspects of aeromagnetic anomalies and the general geological and tectonic structural trends. We propose that the crust in SW Anatolia has a thickness of between 33 and 37.5 km, as evidenced from the Bouguer gravity data. In the Bouguer anomaly map, contour density increases in the south; this can be correlated with the metamorphic basement. The thick metamorphic basement is close to the African-Eurasian collision zone, and the thicker crust is thought to be governing this collision zone.

Magnetization highs and gravity lows correspond to the Isparta (Golcuk crater) volcanic district. The area of the

Golcuk volcanic district in the Isparta region is associated with distinct magnetic signatures, possibly due to the greater thicknesses of the igneous bodies that may be solidified intrusions or magma reservoirs. We suggest that dike-like intrusive bodies in the basement of the Golcuk region, Isparta, are present. The change in the nature of the anomalies of the potential field data may have been resulted from the intense deformation associated with major tectonic activity that seems to have been an important element in shaping the present structural trends of SW Anatolia.

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