O16-5 PETROLEUM AND GEOTHERMAL MODEL OF AEGEAN SEA AND WESTERN ANATOLIA, TURKEY

AHMET ERCAN[1,2]
[1] YERALTI ARAMACILIK Ltd. Spor cad. Acýsu Sok. 9/2 80680 Besiktas- Istanbul, Turkey
[2] ITU Maden Fakultesi Jeofizik Muhendisligi Bolumu, Maslak-Istanbul, Turkey

Western Anatolian tectonics is directly responsible for existing geothermal and nearly discovered petroleum fields in Turkey. According to the intersection hypothesis of Ercan (1997), hot regions are situated at junction points of faults and petroleum is in graben structures. Grabens which extend in NS, NNE-SSW and EW.

According to the regional Bouguer gravity anomaly map, there are essentially two main tectonic trends, in Western Anatolia, one of which lies down in Turkish side of offshore Aegean sea, in N15°W direction of Kusadasý-Gokceada sea zone; in the form of peaarl like chain of high gravity anomalies and other is continental, NS structural divide between extending, Germencik-Balýkesir.

In Kusadasi-Gokceada zone, although the average crustal thickness is about 33 ± 1 kms, it is thinner on the asthenosphere lobes which are 26.5 kms in Kusadasi bay, 28 kms in Dikili bay, and 27 kms in Gokceada (Dardanel's gate). Estimated size of earch such magmatic uprises vary between 10^7 to 10^9 kms^3 . Heat flow is 100 to 150 mW/m^2 and earthquake acceleration values vary around 40 to 60 cm/sec^2 and maximum magnitude of earthquakes 5.5 around these lobes. Such higher gravity lobes are situated at sea extend of EW directing graben which are Great Meander, Small Meander, Hermos (Gediz), Bakýrcay and North Anatolian fault. There are numbers of hot springs and geothermal emissions around these lobes with surface temperatures of 40°C to 150°C.

On the other hand, Germencik-Balýkesir divide is a possible main structural discontinuity, along with where the gravity field is zero. Estimated crustal thickness along this line are 32.5 kms at the Germencik , 37 kms at Salihli, 31 kms at Akhisar with average vertical offset of 3.5 to 4 kms at the possible crustal divide. This line are represented with high heat flow emissions, varying between 80 to 250 mW/m^2 (Ýlkýsýk et. al., 1994) and chain of geothermal fields which areGermencik 232° C, Kursunlu-Salihli 98°C, Mentese 63°C. However, highest heat flow rate, varying between 160 to 250 mW/ m^2 and temperatures at confronted at intersections of Tire-Gordes main fault with EW extending grabens which at Germencik-Omerbeyli 232°C, Kursunlu 98°C, Eynal-Simav 147°C. Average heat flow a-rate of 111 mW/m^2 , in Western Anatolia, is 50 % higher than global rate (Ilkisik et al., 1994). This indicates that 1259°C and 55 ± 5 kms depth lithophere-astenosphere contact is shallow beneath the Aegean. Reduction in electrical resistivity from 30 to 10 ohm-meters (Caglar, 1994) and mantle originated ^3He, CO_2, and CO emissions are another supports for such crustal thinning in this region.

Such intersections are called as, graben in graben (Kaya, 1993, Yilmaz, 1995), and are represented with higher fracturing, high porosity and they also facilitate approachment of astenosphere to the surface and then, they heat up groundwater which result in geothermal. Such intersections are only recognised by local gravity maps. Deepest depth is at Nazilli in Great Menderes basin with value of 5.5 kms (Ercan, 1999) which could be an important potential geothermal field which is presently obsurced by a thick alluvial deposits. A petroleum field was discovered at depth of 1925 m in Tertiary formations, taking place at conjunction point of two basins in the Gediz graben, to the north of Alasehir (Philadelphia) town. There is a good possibility that petroleum trap map exists in the neighbouring Great Menderes graben, in Nazilli. There was delineated a hidden reservoir with 25 km^2 surface area at a depth of 4.5 to 5 km in Tertiary formations similar to those in Alasehir (Manisa).

In summary, shallow asthenosphere chains in Agean Sea and offshore and inland-undiscovered fault or graben intersections on the continental crust are good candidates for future hot geothermal fields as well as hydrocarbon deposits.

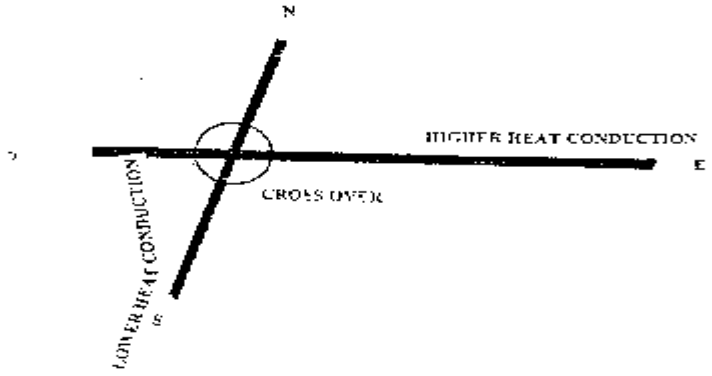

Figure 1. Illustration of cross-over model of faults or grabens which are proposed to be hottest geothermal fields on Western Anatolia. NS Grabens are oldest and occured by NS dominating compressional regime before Miocene and EW extending grabens are youngest and are results of present extensional regime since middle Miocene.

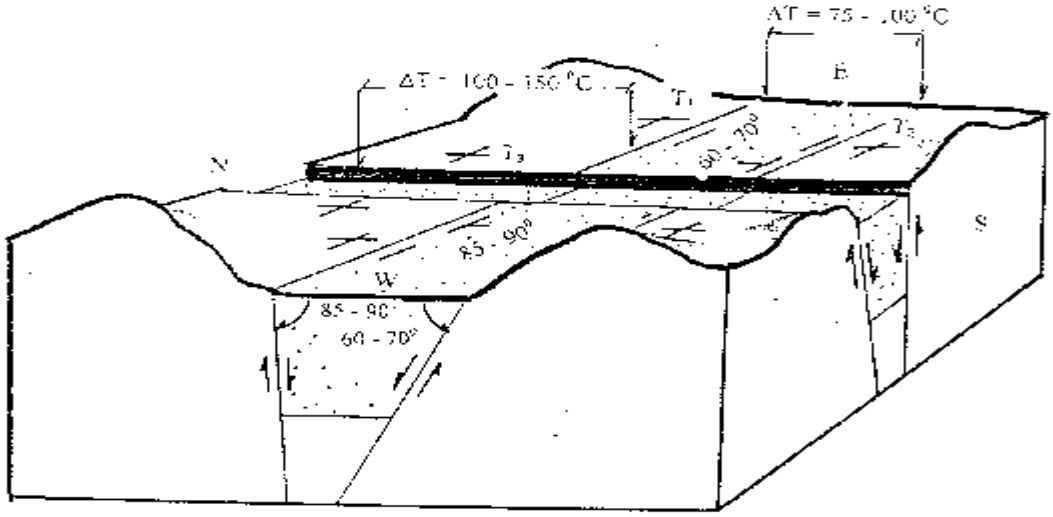

Figure 2: Block diagram of cross-over theory to delineate petroleum and gas fields in NS, EW tectonic regime and temperatue differences between northern and eastern sides of E-W extending and temperature difference between northerly and westerly grabens.

References

Caglar, I., 1994. Guney Anadolu'da Jeotermal Parametreler ile Yerelektrik Verileri Arasindaki Iliskiler. Jeotermal Uygulama Sempozyumu, 94, 27-30 Eylul Pamukkale Univ., s. 328-336.

Ercan, A., 1997. Ege' de Sicakligin Kaynagi: Gocuntu icinde gocuntu taslagi. (Origine of Heat At Aegean Region: Graben in Graben Model) Petrol ve Gaz Dergisi, Ankara.

Ilkisik, O.M., Ozturk, S., Toksoz, T. VE Sener, O., 1994. Jeotermal Sistemler Acosindan 'K' Olcumleri ve Bati Anadolu' da Isý Akisi. Jeotermal Uygulamalar Sempozyumu, 94, 27-30 Eylul Pamukkale Univ., s. 318-327.

Kaya, O., 1993. Izmir ve Cevresinin Yer Yapisi. Izmir ve Cevresinin Jeoteknik Sorunlari Sempozyumu Bilidiriler Kitabi, TMMOB Jeoloji Muh. Od. Izmir Subesi, s. 1-3.

Yilmaz, Y., 1995. Ege Bolgesinin Genc Magmatizmanýn Olusumu ile Litosferin Evrimi Arasindaki Iliski Uzerine Dusunceler. Jeofizik, 9-10; s. 107-110.

Ercan, A., 1999. Is there Any Petroleum in Nazilli.1st Western Anatolia Rownleterial Semp., February, Izmir, (proceedings).