Journal of Physical Science and Environmental Studies
Vol. 3 (4), pp. 48-51, June, 2017
ISSN 2467-8775
Full Length Research Paper
http://pearlresearchjournals.org/journals/jpses/index.html

Investigation of Bafa Lake with Seismic and Marine Magnetic Method

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Accepted 28 June, 2017

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ABSTRACT

About 2000 years ago, the Bafa Lake was formed as a natural lagoon due to filling of the alluvial materials to the front of the Latmos Bay, one of the biggest bay of the Aegean Sea, which were carried by Menderes River. The surface area of the Bafa Bay is about 75 km², it's the location above the sea level 5 m, and it's the deepest part 20 to 25 m. Aegean area is expanded on the N-S direction starting from Miocene seismically, one of the most active regions in the world. The seismic activity of the region caused the formation of the normal faults and grabens on the E-S direction. The Bafa Lake is affected by the active tectonic activity, because it is located within the Big Menderes graben. But, the scientific data of the Bafa Lake is too limited. For that reason, the geophysical studies are planned on the first step of the study. After completion of this study, the formation and morphology of the lake were found out by using seismic and magnetic techniques.

Key words: Active tectonic, Latmos Bay, Geophysical studies, Shallow water and Total magnetic field.

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INTRODUCTION

The Bafa Lake is located at the watery area about 37° 31´ N and 27° 27´ E which is accepted on the international important area list. Besides, the Bafa Lake is very important area for the archaeological case. The Bafa Lake, which is situated in south-western of Turkey, had turned to be a lake as result of geomorphologic development of Buyuk Menderes Delta (Mullenhoff et al., 2004). Bafa Lake is one of the least spoiled watery areas at the shore, in Turkey. The maximum depth of the Bafa Lake reaches to 25 meters. The main water sources of the Bafa Lake are the water floods of Buyuk Menderes, and the underground waters coming from the mountains at the environment (Figure 1). As the cultural and historical values of the Bafa Lake; Heraclia Antic City takes place within the borders of the Lake, at the south west foot of Besparmak Mountains (Mullenhoff et al., 2005). Generally, the Bafa Lake and surroundings are classified by five geologic units called alluviums that are carried by Buyuk Menderes Graben, Cambrian and Precambrian aged gneiss located on Besparmak Mountain, marbles (Milas marble) and Paleozoic-Precambrian aged schists (Okay, 1989). Seismic method and processing is one of the most important methods for morphologic properties of lake or seabed (Çifçi et al., 2005). The reason for this seismic data acquisition was carried out to identify geologic units been around the lake. Especially, high resolution seismic system have used for seabed layers, faults, description of geologic units correlating on seismic section and current and late sedimentary deposits.

In this paper we try to bring out geologic units on the seismic section and geomorphology of lake using seismic and magnetic methods. To perform this study, an equipped research boat with 4 to 6 m of the length was used for the marine investigation at shallow water. At the first step of the study, data acquisition was completed and according to the methods which are stated on the study that high resolution seismic and total magnetic area measurement performed. In the result, this study was the first study, especially, for the Bafa Lake. After we interpret seismic data for morphological properties of Lake Bottom and we try to support seismic data with

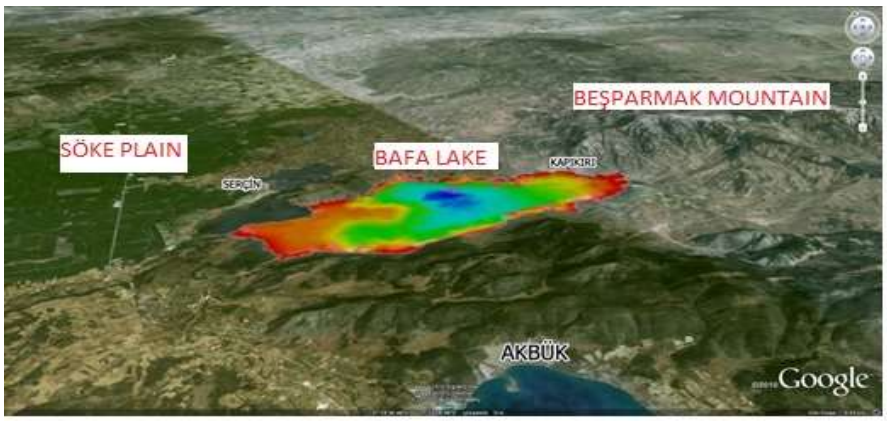

Figure 1. Bafa Lake and surrounding (Colours are identified depth contours on the Bafa Lake).

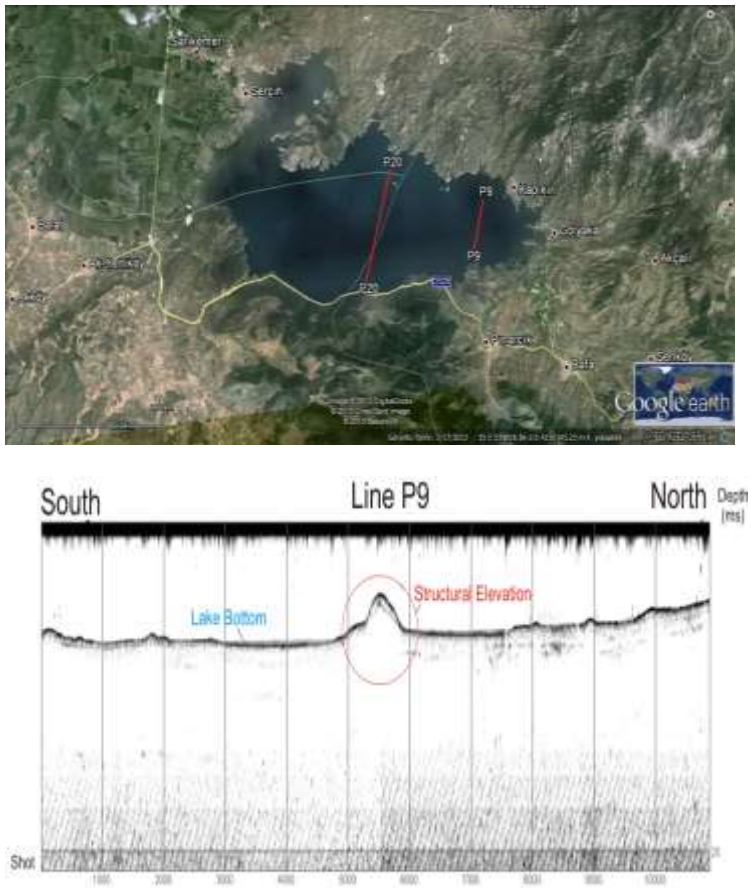

Figure 2. P9 seismic line.

magnetic data. Magnetic data use to generate total magnetic map due to definition of rocks around the lake and the effects of islands in the lake.

MATERIALS AND METHODS

High Resolution Seismic Method

The seismic data acquisition was performed by using 3.5 KHz Sub-bottom Profiler system which is very advantageous for many geologic settings that observed on seismic profiles. When these seismic profiles interpreted, current sedimentary sequences that have been found on the lake bottom are seen as seismic stratigraphic structure depends on aquatic impedance. Geologic units been defined by researches have tried to obtain on the seismic reflection section. For example, gneiss in the north side on the Besparmak Mountain was seen on the seismic line that applied east-west direction. These gneiss rocks show themselves in the form of structural elevations (Figures 2 and 3).

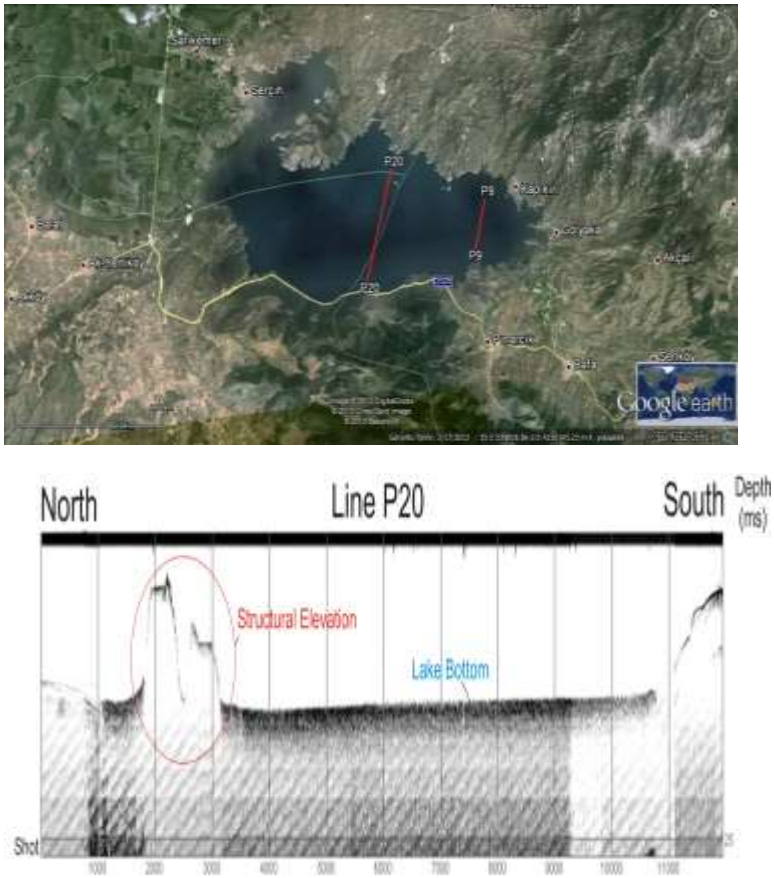

Figure 3. P20 seismic line.

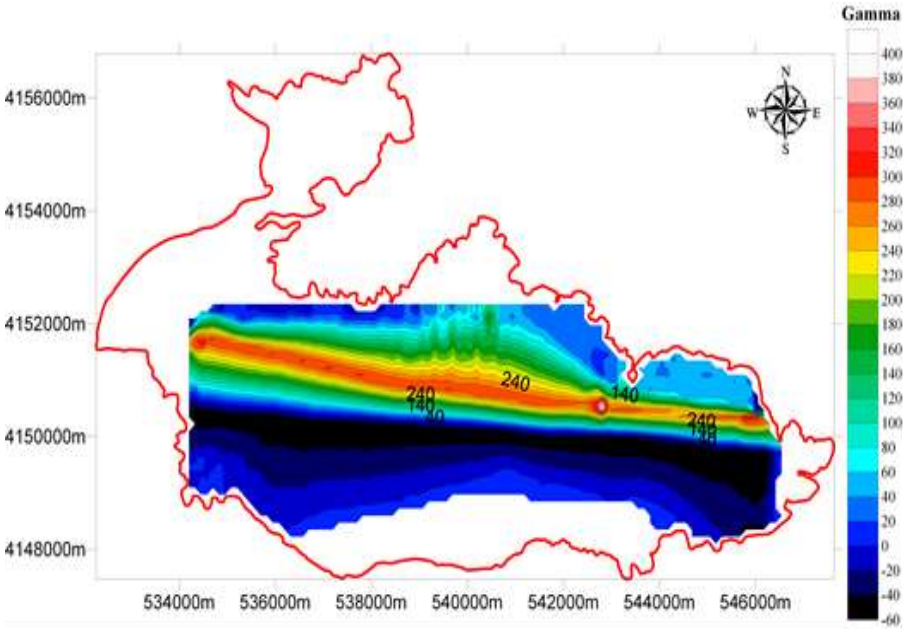

Figure 4. Total magnetic field map.

Marine Magnetic Method

Marine magnetic method is used to find metallic coating matters especially been different features from environment density and very sensitive for determination of ferro-magnetic and metallic objects on the study area. Our magnetic system has 1 gamma magnetic field alteration (SDM-4000 – Dijital Manyetometre Manuel

Notes). Magnetic surveys are executed by recording of total magnetic field values. This system has attained coordinate information using DGPS navigation system and zeroized local total magnetic field value editing otomatically depending on its coordinate system. Magnetic data collected by our system were mapped using Surfer software at intervals 20 gamma changing (Figure 4). When total magnetic field map interpreted, residual values were not run across. The important point on the map is that magnetic values are increased northward. This situation is related to the structure of Besparmak Mountains which have been made up of gabbro like granite and gneiss. This result showed that high gamma values intensively are found in the northside of lake owing to highland. According to this interpretation, magnetic field values are classified by high gamma present rocks that have dense magnetic properties and low gamma has not dense magnetic properties, too. Also, in this total magnetic field map contour enclaves are indicated effects of islands on the lake because islands have high magnetic anomaly value.

CONCLUSION

We propose the accurate way to search out seismic and magnetic method for morphology and definition rocks been on the lake and its surroundings. Our approach is based on interpretation of seismic section and total magnetic field map. They allow us to identify geologic units using seismic and magnetic systems. These methods have been carried out as profiles which collected north-south direction to seismic system and east-west direction to magnetic system. In this paper, we show that seismic and magnetic methods are applicable for classification of rocks on the lake and around. In the result, we can use these methods for geomorphology of lake or sea in relation to geology.

ACKNOWLEDGEMENTS

We thank Dokuz Eylul University Institute of Marine Science and Technology for the authorization to present this work.

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