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Determination of Radioactivity in Surface Waters and Lake Waters

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AIM

The purpose of these studies is to measure radioactivity levels in the surface waters (river, stream, lake etc.) and to provide data for the distribution of naturally occurring radionuclides uranium and radium in the streams/rivers and to obtain information about the relation between concentrations of uranium and gross radium activity and the geological formation of streams/rivers.

The completed projects:

RESEARCHING OF GEOCHEMICAL DISTRIBUTION OF RADIOACTIVITY IN THE VAN LAKE BASIN SURFACE WATER

A. Umit Tolluoglu, Meral Eral, Sule Aytas, Ayse Yuksel, Sema Akyil, Yahya Ciftci, Mehmet Akif Isik, Onur Kose, Mahmoud A. A. Aslani, D. Alkim Turkozu

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RADIOACTIVITY LEVELS IN SURFACE WATER OF LAKES AROUND IZMIR/TURKEY

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Supported by Ege University Scientific Research Project No:2004 NBE 005.

Current Project:

ASSESSMENT OF VAN LAKE IN THE ASPECT OF RADIOLOGICAL AND HYDROGEOCHEMICAL RISKS

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Joint Project Proposal (will be supported by TUBITAK-TURKEY and BAS-BULGARIA) PRELIMINARY SPATIO-TEMPORAL SURVEY OF RADIOLOGICAL AND CHEMICAL POLLUTION IN TRANSBOUNDARY RIVERS BETWEEN TURKEY AND BULGARIA

Bulgarian Academy of Sciences, INRNE, Sofia-BULGARIA Ege Univ. Institute of Nuclear Sciences, Izmir-TURKEY

Geology of Van Lake Basin

- The Van Lake Basin was formed around the 100.00 years ago. Principally Van Lake Basin consists of three different geographical parts.
- According to geographical classification mentioned above main lithological formations can be classified into four section
 - 1- Paleozoic-Mesozoic metamorphic rocks,
 - 2- Mesozoic ultramafic-mafic ophiolitic rocks,
 - **3-Miocene-Pliocene aged sedimentary rocks,**
 - 4-Pliocene-Quaternary alkaline volcanic rocks which some prominent radioactivity measurements obtain from these rocks.

- Van Lake is situated in the eastern part of Turkey and has a surface area about 600 km² located at an altitude of 1650 m.
- It is largest soda lake on Earth with an area of 3522 km², water depth of 451 m, and a water volume of 576 km³.
- The geology of the Lake Van area is controlled by its position near the boundary of Eurasian and the Afro-Arabian continental plates.
- Associated tectonic activity has led to extensive and still active volcanism, resulting in the formation of alkali-rich lavas.





Fig. 1. Location of Van Lake and satellite picture of Van Lake Basin in TURKEY.

Fig.2. Geology map of the Van Lake Basin,Turkey





Mesozoic Ultramafic-Mafic Ophiolitic Rocks

Sedimentary Rocks

Alkaline Volcanic Rocks

25km

0 km



Metamorphic Rocks



Fig. 3. Map of streams in Van Lake Basin and sampling stations on the streams.



Fig.4. Sketch geology map and surface measurement locations in Van Lake Basin

Sampling and Sample Preparation

In the field:

UTM coordinates, altitude, temperature, humidity, air pressure, dose rate (μ R/h) and surface gamma measurements (cps) were recorded.

(Portable gamma dose rate meter to measure external gamma exposure levels (μ R/h) and portable gamma surveymeter to measure external gamma levels (cps,counts per seconds) were used in performing the measurements in the field)

In the water samples:

pH, mV, temperature, specific electrical conductivity, alkalinity, uranium concentration, gross radium isotopes activity, gross alpha and gross beta activities were determined

- In order to measure radioactivity in surface water of the Van Lake Basin, a total of 119 surface water samples were collected from 9 streams in dry season in 2003.
- After recoding some parameters in the field, the samples were acidified with nitric acid and transported to the laboratory for analysis within a short time.
- Surface gamma and dose rate measurements were made 1 m above the ground level at the different 47 locations in Van Lake Basin.



Fig. 5. Contour map surface gamma measurements in Van Lake Basin.



Fig. 6. Contour map of dose rate in Van Lake Basin.



Fig. 7. Frequency distribution and contour map of pH in surface water of Van Lake Basin.

The mean pH value of the surface water is 7.90±0.49.



Fig. 8. Frequency distribution and contour map of conductivity in surface water of Van Lake Basin.

The mean specific conductivity of the surface water is 450±442 µs/cm



Fig. 9. Frequency distribution and contour map of alkalinity (NaHCO₃) in surface water of Van Lake Basin.

The mean alkalinity value of the surface water is 382±240 mg/L



Fig. 10. Frequency distribution of uranium in surface water of Van Lake Basin.

The mean uranium concentration of the surface water is 1.5±1.0 ppb



Fig. 11. Frequency distribution and contour map of gross Ra in surface water of Van Lake Basin

The mean gross radium isotopes activity concentrations in the surface water samples is f 0.022 ± 0.002 Bq/L.



Fig. 12. Frequency distribution and contour map gross alpha in surface water of Van Lake Basin.

The mean gross alpha activity in the surface water is 0.24±0.1 Bq/L

Gross beta activities in surface waters (119 Samples)

Interval : 0.04- 5.00 Bq/L Mean value : 0.8±1.7 Bq/L



Fig.13. Frequency distrubition and Contour map of absorbed dose rate in Van Lake Basin.

The mean absorbed dose rate in Van Lake Basin is 58±31 nGy/h

The average value of terrestrial gamma radiation dose rate in Van Lake Basin was estimated to be 58.22±31.12 Gy/h and the world average is 59 nGy/h (UNSCEAR, 2000). Using the conversion factor of 0.7 Sv/Gy (UNSCEAR, 2000), the average dose from such a terrestrial gamma radiation dose rate to an individual assuming is estimated to be 0.07 ± 0.03 mSv/year, which is considered to be within the normal range for doses from natural sources.

RADIOACTIVITY LEVELS IN SURFACE WATER OF LAKES AROUND IZMIR/TURKEY

Sema Akyil, Sule Aytas , D. A. Turkozu , Mahmoud A. A. Aslani ,Sabriye Doyurum , Aysun Kilincarslan Kaygun , Meral Eral Supported by Ege University Scientific Research Project No:2004 NBE 005.

- The determination of gross alpha and gross beta activities in the lakes of Izmir region were realized. Three lakes were considered in this study:
- **Karagol Lake** is a tectonic landslide, crater lake at altitude 810 m and lies at the latitude 38° 33' N and 27°13' E longitude;
- Golcuk Lake is also a tectonic originated at altitude 1050 m and lies at the latitude 28°05 N and 38°30 E longitude;
- Cakalbogaz Lake is in Kucuk Menderes Delta (sea level) and lies at the latitude 37°59' N and 27°19' E longitude in Western Turkey.

- While Golcuk Lake's water is important for the farmers who being used to irrigation of agricultural land surrounding it, and being used for fishing also.
- The latter is also essential for Cakalbogaz Lake; however, Karagol Lake is used as a recreation place only. Unfortunately, there is no data on aquatic radioactivity measurements on these lakes, according literature surveys.
- The subject of this study is the assessment of the current radioactivity state of these lakes located around Izmir/Turkey. The samplings were performed in autumn seasons in 2005 at sampling locations, and totally 91 surface water samples were taken from these lakes. After radioactivity measurements realized, the obtained data was analyzed statistically and contour maps were drawn and evaluated.



Fig. 1. Locations of Karagol Lake, Golcuk Lake and Cakalbogaz Lake around Izmir and sampling points.



Fig. 2. Frequency distribution and contour map for Karagol Lake water.

Mean gross alpha, beta activity and uranium concentration are 0.03 ± 0.01 Bq/L, 2.62 ± 0.74 Bq/L and 69 ± 0.05 ppb, respectively.



Fig. 3. Frequency distribution and contour map for Golcuk Lake water.1

Mean gross alpha, beta activity and uranium concentration are 0.75 ± 0.14 Bq/L, 2.35 ± 0.38 Bq/L and 0.09 ± 0.14 ppb, respectively



Fig. 4. Frequency distribution and contour map for Cakalbogaz Lake water.

Mean gross alpha, beta activity and uranium concentration are 0.03 ± 0.02 Bq/L, 1.77 ± 0.09 Bq/L and 4.16 ± 1.9 ppb, respectively

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Van Lake

Nemrut Crater Lake



THANKS FOR YOUR ATTENTION





Meke Lake