

INVESTIGATION ON GOLDEN HORN (HALIÇ) QUATERNARY SEQUENCE BY DETERMINATION OF ALPHA AND BETA RADIOACTIVITY LEVELS*

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ABSTRACT

Radioactivity level is a factor that affects of environmental variations. In this study, quaternary sequence was evaluated by the discussion of radioactivity anomalies. For this purpose, an example drill samples of quaternary sequence were found from Golden Horn (Haliç) quaternary sequence. Samples were prepared with grinding and sieving carefully. Then, the measurements were taken in two different counting system for beta and alpha measurements. Alpha and beta radioactivity was evaluated by using related calibration curves. Results of the study, it is evident that especially alpha count rates can be used for the clay evaluation because of the clay which has more magmatic elements that include uranium and thorium in it. So it is shown that the alpha counting technique can be used for general evaluation of the quaternary sequence easily.

INTRODUCTION

A whole complex of environmental factors presses each other and affect on the environmental consequences. The interplay between man and each environmental factor and that between the various factors themselves are fascinating in their great intricacy and delicate balance. So, sometimes, one of the them should be important and can show the variations of other factors.

Knowledge of the distribution of uranium, thorium and potassium in specific regions of the outer crust is fundamental to understanding of the earth's budget. So long as definitive quantitative information is lacking, the driving forces behind such basic earth processes as mountain-making, magmatism, and metamorphism remain matters of quantitative, or at best semiquantitative conjecture (Phair & Gottfried, 1962).

Distribution of uranium and thorium in the igneous rocks, ore deposits and weathering products of the special region of the crust is important for that region in the point of its formation. I the other hand, all the regional enrichment in potassium is another important specification of the region of the earth.

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Uranium, thorium and their chain products are radioactive like as potassium-40 which is placed in natural potassium. Under test is the extent to which the total radioactivity of crust may be used as an indicator of local regions (Phair & Gottfried, 1962). So, the radioactivity level is a factor that affects of environmental variations for the evaluation of that place.

In this study, quaternary sequence was evaluated by the discussion of radioactivity anomalies. For this purpose, an example drill samples of quaternary sequence were taken out the Golden Horn (Haliç) quaternary sequence.

METHOD AND EXPERIMENTAL PROCEDURES

The samples of Golden Horn (Haliç) quaternary sequence are supplied from the Geology Division of Istanbul University. That are taken of the crust from Galata region in the vicinity of Golden Horn.

Samples were prepared with grinding and sieving carefully. So the samples were taken in similar style and rational position. Sieving procedure were done in automatic sieving equipment in 1 hour. 2 mm (Mesh No. 10) is selected as sieving size, but all type soil can be possessed in the samples. Net weighted amount determined for each sample and to be ready for counting inplanchets.

For the determination of alpha and beta radioactivity level for the grid soil samples, to be carefully selected the counting systems due to original difference of the radiations. Many different systems or detectors can be used for the alpha or beta particles detection.

One of the most widely used methods for the activity standardization of alpha emitting nuclides that of 4π counting. The intrinsic efficiency of a well designed 4π counter is assumed to be 100 percent for charged-particle radiation. (NCRP 58, 1985). The 4π counter was the preferred for the assay of some radioisotopes.

Proportional counters can be used as 4π counter for detection of alpha radioactivity can be called as low-geometry that defined solid angle (NCRP 58, 1985). In the recent years, silicon surface-barrier detectors are used widely for the purpose of alpha counting.

The assay of alpha-particle-emitting source by the methods of 2π geometry generally preferable in many times. 2π geometry requires essentially the measurement with one half of 4π system, and all considerations can be applied similarly (NCRP 58, 1985)..

Alpha particles are less easily scattered from the backing, so that the fraction of the alpha particles scattered into the 2π counter is far less than in case of beta particles. It have shown that back-scattered alpha particles move predominantly into angles of less

than 5° from the plane of the source mount (Walker, 1965). Large-angle Rutherford scattering negligible for almost all 2π counting (NCRP 58, 1985).

It can be conclude the back-scattered alpha particles is between zero and five percent of the number emitted into 2π steradians (Deruytter, 1962, Hutchinson et al., 1968). It depending on the thickness and uniformity of the source material, and the energy of the alpha particles.

Also, alpha particles are emitted in mono-energetic groups with much higher energies than beta particles. Therefore, they are characteristically emitted in a spectrum of energies. So, alpha counting can be observed rationally.

After preparing the samples, then the measurements were taken in two different counting systems for beta and alpha measurements. Different types of detectors were used for alpha and beta measurements. Fig. 1 and Fig. 2 shows the block diagrams of the measurement systems for alpha and beta counting respectively.

For net beta counting rate, at first, total counting rate were taken including beta, gamma and background counts in the same counting geometry. After that, a thick aluminium plate was placed between sample and detector, then sub-counting was taken from total counts for the same interval. It means that gamma and background counts take out, so, the net beta counts were taken in two stages.

RESULTS AND DISCUSSION

In the results of the experiments six different grid pattern in order to establish the variability of different soil types. Alpha and beta activity levels of the samples for Haliç Quaternary Sequence are shown in Table 1. Graphical evaluation can be seen in Fig. 3 and Fig. 4 alpha and beta radioactivity results respectively.

Table 1 : Experimental Results for Golden Horn (Haliç) Quaternary Sequence

Sample No	Depth of Samples in Golden Horn (Haliç) Quaternary Sequence (m)	Beta Activity (cpm)	Alpha Activity (cpm) $\pm < \% 10$
HK-17/0	0.00 – 1.50	34.62 ± 2.15	0.67
HK-17/3	3.00 – 3.45	24.55 ± 2.99	0.85
HK-17/6	6.00 – 6.45	18.52 ± 1.37	0.59
HK-17/9	9.00 – 9.45	19.54 ± 0.79	0.42
HK-17/15	15.00 – 15.45	28.50 ± 4.25	1.13
HK-17/21	21.00 – 21.45	22.86 ± 3.53	0.41

According to the result of the experiments in Table 1, it can be said that they are valuable and identified the soil quaternary characterisation of Golden Horn (Haliç). The alpha and beta measurement levels can be compare with two different grid samples for different places in the earth in Table 2. It can be said that the experimental results for Golden Horn (Haliç) are convenient general crust data for alpha and beta radioactivity levels measurements.

Table 2 :Alpha and Beta Radioactivity Results For North of Sharpsburg Town in U.S.A.

Sample No	Depth of Samples in Sharpsburg Town (m)	Beta Activity (cpm)	Alpha Activity (cpm)
Grid 64C	0.00 – 0.08	23.90 $\pm$ 2.00	0.52 $\pm$ 0.22
Grid 64-0	0.00 – 0.15	27.00 $\pm$ 2.10	0.48 $\pm$ 0.23
Grid 64A	0.05 – 0.20	19.00 $\pm$ 2.20	0.52 $\pm$ 0.32
Grid 64	0.20 – 0.35	22.00 $\pm$ 2.10	0.57 $\pm$ 0.29

For the clay and shale formation, the alpha radioactivity level is high, but the sandy or silty soil the alpha radioactivity is low (Sahin, 2000). In the clay or shale, uranium and thorium amount is high. But the potassium can be placed in the many types of soil, but generally outer layers of the crust is more rich than the inner. If the results are evaluated in according to these concepts, it can be noticed that the beta radioactivity levels shows decreasing trend in going through the depth. That is expected results with dependency of the soil types in the Golden Horn (Haliç) quaternary sequence.

But one of the experimental result for alpha radioactivity level is mostly high in Golden Horn (Haliç) quaternary sequence. That is mostly important , because of the increasing trend goes down again after that depth level. It can be seen in Fig. 3 as a peak that can be evaluated in the different means, which is over the 1 cpm. It is investigated for the formation for Golden Horn (Haliç) quaternary sequence in general region geologic formation. In Fig. 5 and Fig 6 show the geological map for Marmara and Turkey. There is geologic activity nearly the Golden Horn (Haliç) (Okay, 1999,[http:// www.eis.itu.edu.tr/avr.home.1htm](http://www.eis.itu.edu.tr/avr.home.1htm), 2000).

CONCLUSION

Results of the study, it is evident that especially alpha count rates can be used for the clay evaluation because of the clay which has more magmatic elements that include uranium and thorium in it. Inversely, alpha-counting rate goes down when the samples include mostly silt and sand.

However, beta-counting rates were around an average value because of beta active elements which belong to both magmatic and the other type soils. So it is shown that the alpha and beta counting technique can be used for general evaluation of the quaternary sequence easily.

Especially the alpha counting rate is more important for the evaluation of the quaternary sequence. For the Golden Horn (Haliç) quaternary sequence, it also noticed an important alpha peak.

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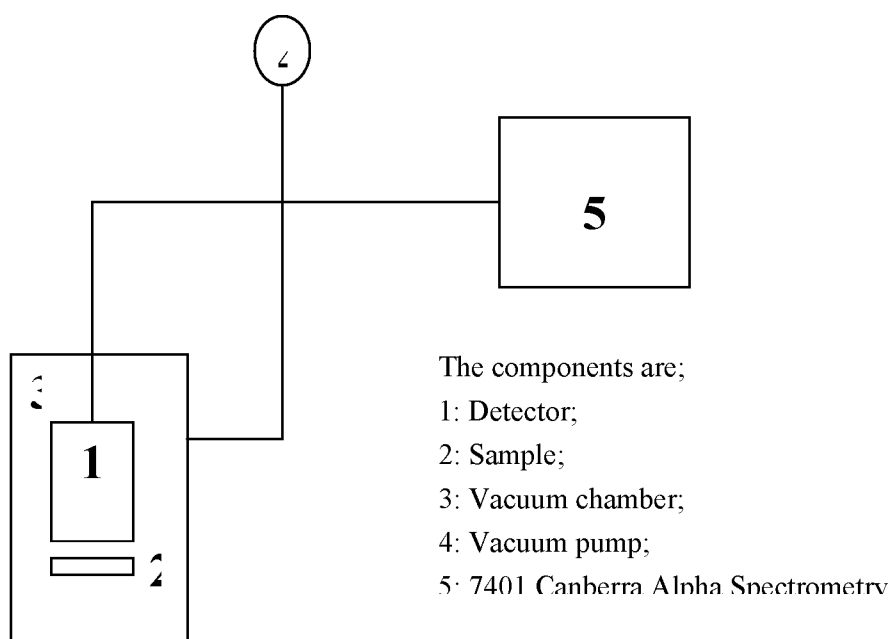


Fig. 1. The Block Diagram of The Alpha Counting System.

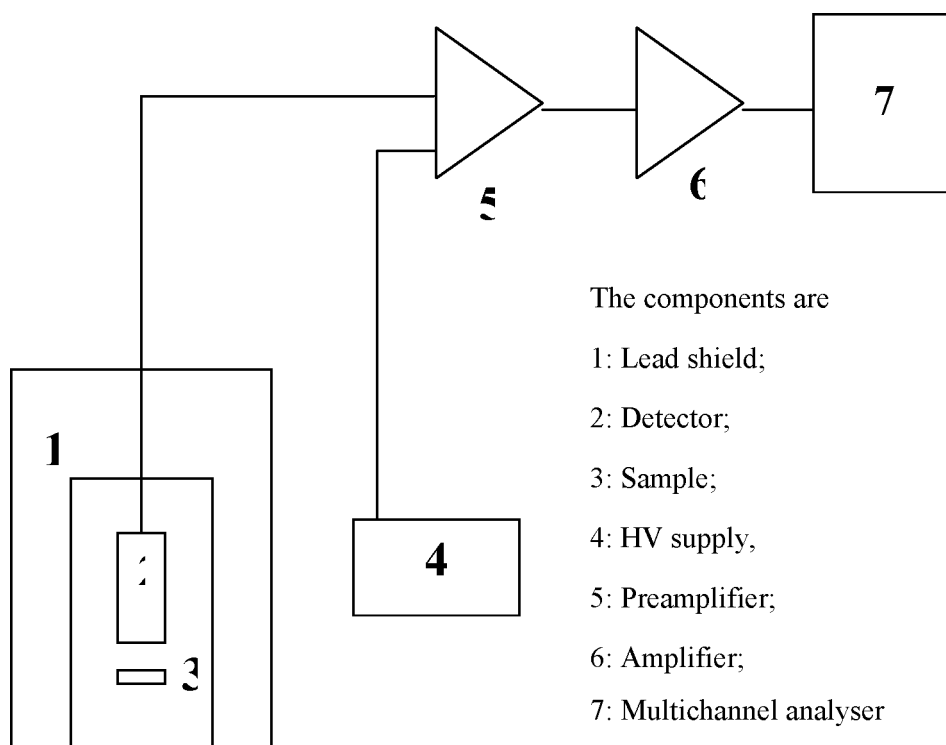


Fig. 2 The Block Diagram of The Beta Counting System

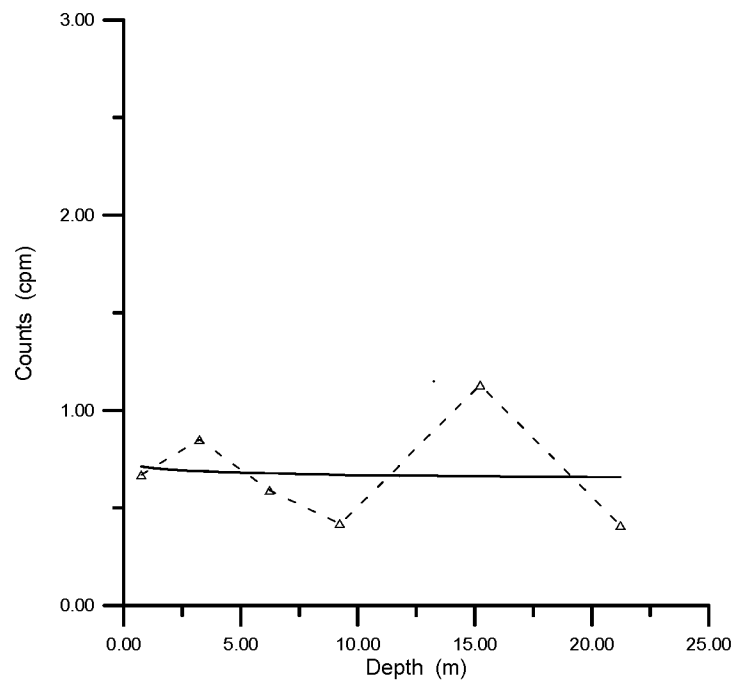


Fig. 3 Results of Alpha Counting For Golden Horn (Haliç) Quaternary Sequence

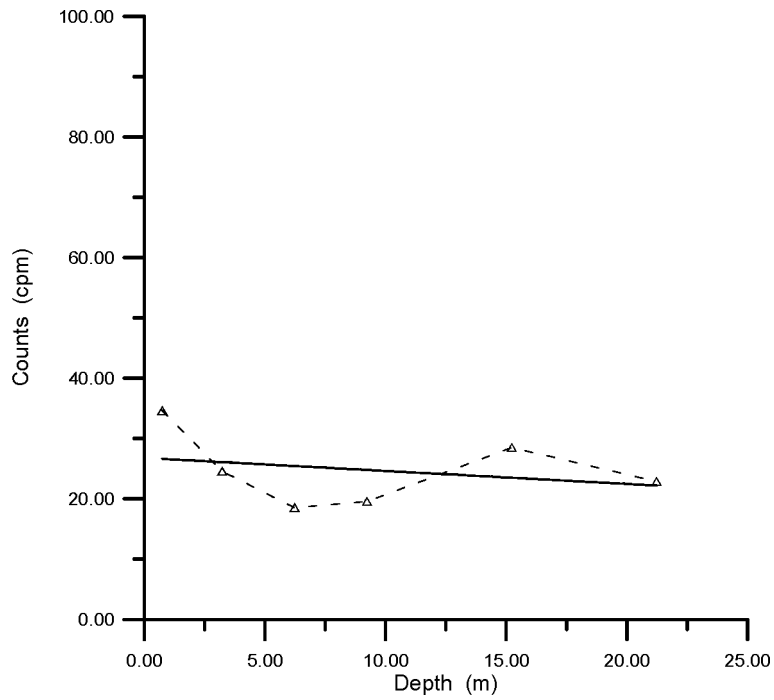


Fig. 4 Results of Beta Counting For Golden Horn (Haliç) Quaternary Sequence

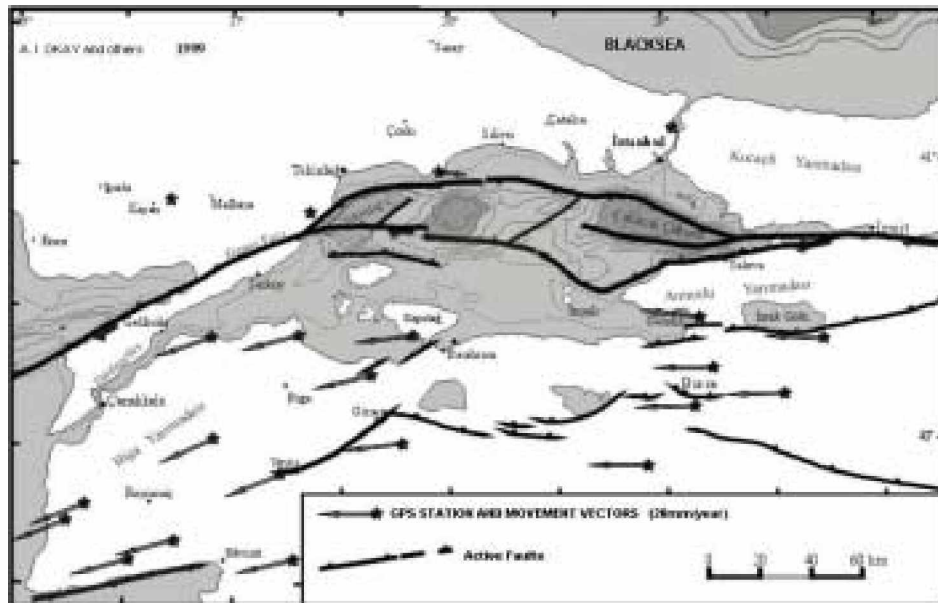


Fig. 5 Geological Map of Marmara (Okay, 1999)

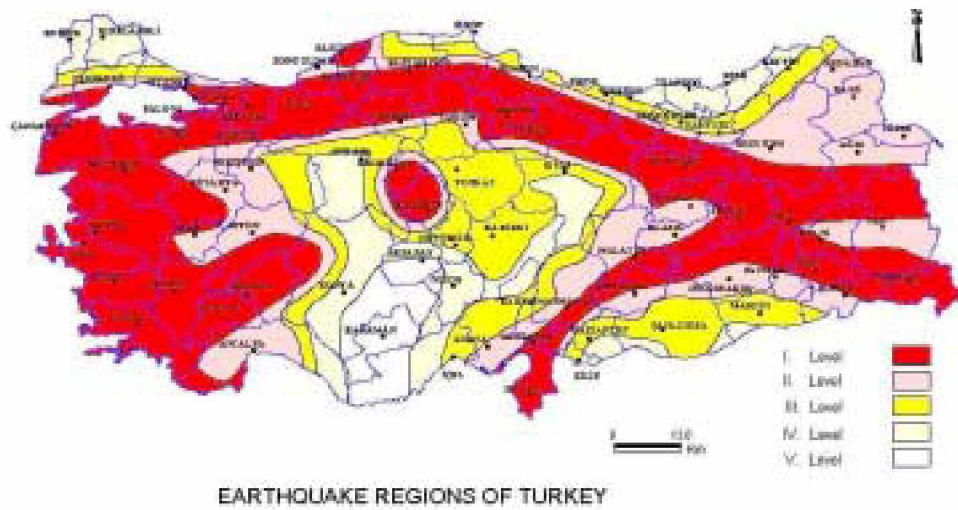


Fig. 6 Earthquake Regions of Turkey