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Assessment on Natural Radiation Level of Carbonate based Natural Stones from Turkey

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Abstract: The natural stones are commonly used construction materials in life of mankind due to their large reserves in the nature and high strength capacities compared to other construction materials. Scientific and technological advances have increased the use of chemical content in building materials. This has caused to an increase of health problems in last decades. For this reason, there has been a significant increase in the use of natural stone in living areas. The nine natural stone samples, which are obtained from different locations of Turkey, are investigated in terms of textural and geochemical properties in this study. In addition, the radium equivalent activity (Raeq), the absorbed dose (D), the effective dose rate (DE), the external (Hex) and internal (Hin) hazard index were also calculated and compared to the international standards values. According to the petrographic examinations, the investigated natural stone samples are in Limestone, Travertine and Marble. All samples are mostly consist of carbonate minerals (mostly calcite and ± dolomite) and rare amount of clay and Fe-oxide minerals under microscope. These results are also supported by XRD (X-Ray Diffractometer). Natural stone samples display similar compositional distribution in terms of major oxide and some trace elements. Hence Ca (wt %) of the natural stone samples from 37.73-39.07, Mg (wt %) 0,002-0.315, Fe (ppm) 1-1350 (as total iron), Mn (ppm) 18-697 K (ppm) 166-448, Sr (ppm) 43.3-680.3, U (ppm) <1and Th (ppm) 0.4-2.3. These values are in accordance to the limit values of radioelement concentrations for carbonate rocks. , and activity values changing between 12.14(±1.46)-37.16(±7.43), 42.65(±8.10)-85.59(±10.27) and 138.65(±18.02)-413.29(±66.13) Bq/kg respectively and do not exceed the world average levels. The calculated values of Hex and Hin index are found to be 0.26-0.45 and 0.31-61, respectively. Furthermore, the annual effective dose rates in air are determined between 50.81 and 101.65 μSvy-1. As a result, the natural radioactivity levels of carbonate based natural stones are acceptable for using as a building materials and decoration.

Key Words: Marble, Petrography, Natural Radiation Level, Carbonate Rocks

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