# ABSTRACT

**INVESTIGATION ON DETERIORATION MECHANISMS**

**OF THE BASALTS EMPLOYED IN THE**

**DİYARBAKIR CITY WALLS**

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The Diyarbakır City Walls (DCW), which were recently added to UNESCO’s World Heritage List, are among the largest and most impressive monuments from ancient times. Basalts having such different textural properties as massive and vesicular were employed as the principal material in the construction of the DCW. Like many other historical structures, the DCW are suffering from stone deterioration. A large variety of weathering forms can be observed on the basalts used in different sections of the DCW. This dissertation investigated the causes of deterioration in the basalt with which the DCW were constructed. It also ranks the causes of deterioration and indicates proper materials and construction techniques to assist conservation studies. To accomplish this, fresh and weathered basalts samples were collected from different sections of the study area. Throughout the study, the mineralogical, petrographic, geochemical and physico-mechanical properties of the samples were evaluated. In order to study the physical deterioration of the basalts and to determine their durability, environmental conditions were artificially simulated in accelerated weathering tests including the wetting-drying, freezing-thawing, and salt crystallization. The durability of the basalts was assessed by determining their average-pore diameters, saturation coefficients and wet-to-dry strength ratio. The outputs of this study indicate that detachments and material losses are the most common deterioration forms on the DCW. Mineralogical and petrographic analyses highlight that iddingsite is the common secondary mineral developed through the crystal boundaries of olivine. Microfracture studies confirmed that olivine and pyroxene are the most vulnerable minerals with the highest number of microcracks. The microfracture density of the vesicular basalts, as a result of crack propagation originated from the edge of vesicles, is relatively higher than that of the massive basalts. It is found that the salt crystallization is the most effective accelerated weathering test deteriorating the basalt samples most aggressively. Of the durability methods used in this study, the durability of the basalts is best assessed by wet-to-dry strength ratio. The field and laboratory studies show that, although chemical processes trigger the deterioration mechanisms of the basalts, most of the weathering forms on the DCW are controlled by the physical processes. The massive samples yielded better results in the parameters of porosity, water absorption, Uniaxial Compressive Strength and wet-to-dry strength ratio. Field observation and laboratory studies indicate that both massive and vesicular basalts are durable; however, the massive basalts are more durable than the vesicular ones.

Keywords:Basalt, City walls, Deterioration, Physico-mechanical properties, Diyarbakır