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Acid Rain Affects on Historical Monument of Troy

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Acidification, Troy, environment, pollution

Abstract

Troy is ancient city from Greek poet Homer's famed epics "The Iliad" and The Odyssey Dardanelles's coastal plain in northwest Turkey, the 4,000-year-old. Acid rain affects historical monument on Troy's structures. Acids have a corrosive effect thermodynamics is the resistant type of rock used as building material in Troy's building. Mostly of building material is volcanic and metamorphic rocks mainly 69 % quartz and SiO_2 mineral components. It is well established that either wet or dry deposition. Acidification low values (0.772 ± 0.797 mg) by variability temperature (5, 10, 15, 20, 25^o C), pH 2-5 and time (30, 60, 90, 120 minutes). Because of volcanic and metamorphic components.

Introduction

Troy is take place a top the hill of Hisarlık, overlooking the Dardanelles's coastal plain in northwest Turkey, the 4,000-year-old ancient city and one of the most famous archaeological sites in the world. Troy, with its 4,000 years of history, is one of the famous archaeological sites with significant remains of a Bronze Age city and a substantial fortification. The siege of Troy by Mycenaean warriors from Greece in the thirteenth century B.C., immortalized by Homer in The Iliad, and Virgil's The Aeneid, which provided and continue to provide lasting inspiration on the creative arts for over more than two millennia Criterion. The archaeological site of Troy is of immense significance in the understanding of the development of European civilization at a critical stage in its early development. It exhibits a more than 3000-year long unbroken settlement sequence where a succession of civilizations may be seen and studied. Of special importance is the role of Troy in documenting relations between Anatolia, the civilizations of Anatolia and the burgeoning Mediterranean world criterion (UNESCO, 1998). A total of 46 buildings were unearthed during the excavations in Troy (Uçankuş 2000).

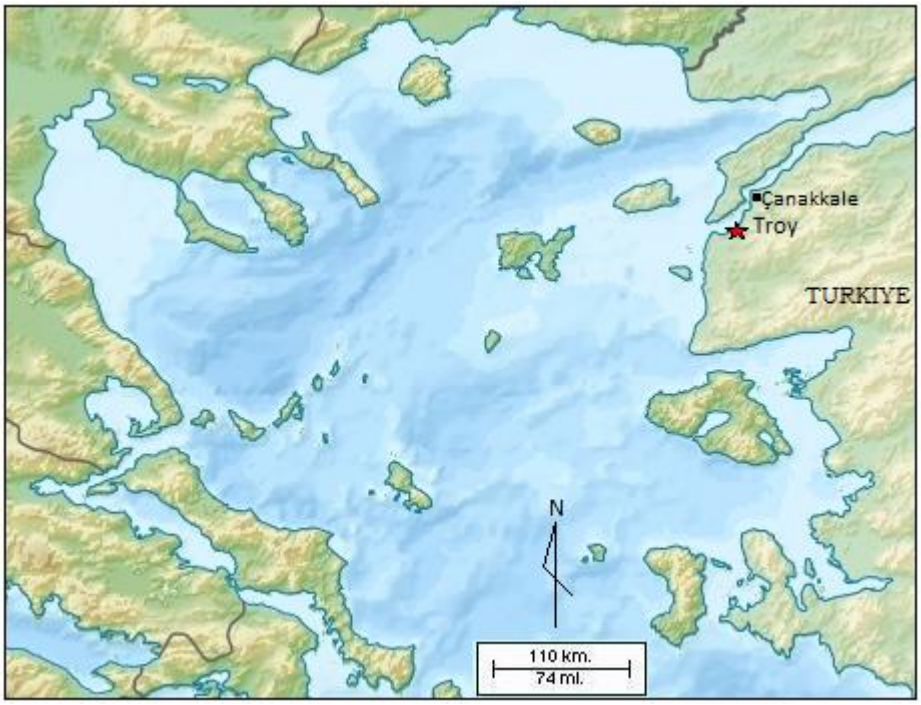

Figure 1. Study Location

Troy a city so magical, so mythical in essence that it even became the subject of ancient Greek poet Homer's famed epics "The Iliad" and "The Odyssey."This war of epic proportions occurred sometime around 1200 BCE, in the north-western part of Anatolia. It is a story so famous it bears little need for excessive explanation: It can safely assume that the enduring survival and relevance of the story of the Troy war, immortalized in the Greek epic poem the Iliad by Homer, has ensured that most of you are familiar with it. The site consists of a mound with c. 25 m. of deposits and a 1 km. sq. skirt to the south. It was noted by F. Kauffer (1793), identified as classical Ilion by E. D. Clarke (1810) and as Homeric Troy by C. Maclaren (1820). Soundings by Frank Calvert (1863, 1865) revealed prehistoric strata. H. Schliemann excavated much of the mound (1870–90), further excavations being by W. Dörpfeld (1893–94), C. W. Blegen (1932–38), M. O. Korfmann (1988–2006) with C. B. Rose, and since 2006 by E. Pernicka. (Blegen CW and D. F. Easton, 2016).

German archaeologist Schliemann accepted the Iliad as his guide. In 1870, he started an excavation on the Hisarlık Hill in Çanakkale to find Troy. He found the treasure in the walls. Schliemann did not want to leave the treasure where it belonged or hand it over to the officials of the Ottoman state (Bulgurlugün, 2001). Schliemann kept the Trojan Treasure a secret and smuggled it across the Ottoman borders to Athens in Greece, his wife's homeland. He tried to sell the treasure first to the Greek government and then to France. When it failed, he offered it to the Russians. Schliemann displayed the treasure in London in 1877. The exhibition made a worldwide impact. Schliemann gave the most important pieces of this priceless treasure stolen from Troy to the Ethnological Museum of Berlin. The Trojan treasure survived World War I and was hidden in a place sheltered from air raids during World War II. It was preserved in the vaults of the Prussian State Bank and in a shelter near the Berlin Zoo. After the war, he remained unaccounted for and his where about remained a secret for years. In the early ‘90s, it was discovered that the treasure was secretly taken to Moscow after the war and held in the vault of the Pushkin Museum of Fine Arts.

In February 1997, the sub commission of the Russian parliament announced that all the artifacts taken from Germany to Russia after the war were permanent properties of the Russian government. Turkey also continued its efforts to retrieve the pieces of the treasure that were taken to other countries. As a result, 24 gold pieces of jewelry (some of part treasure) that were stolen from Troy were returned to Turkey in collaboration with the Penn Museum in the U.S. in 2012 (https://www.skylife.com/en/2018-03/treasures-of-troy).

Figure 2. View from Troy historical artifacts

The air pollution in the form of acid rain may be chiefly responsible. The pollutants that are principally responsible for acid rain are sulphur dioxide and nitrogen dioxides. Most of the research studies showed the effect of acid rain caused by wet and dry deposition the effect on ancient monuments. The report stated that it was caused by the emission of various oxides, particularly sulphur and nitrogen collectively referred to as SOx and NOx and chemical transformation via the photochemical processes and chemical reactions, the end result is of sulphuric (H_2SO_4) and nitric (HNO3) acids being produced (MMS, 1988). All most all historical monument are built up with lime stone which are most vulnerable to corrosion. The historic structures all around the world are affected by acid rain because of firstly sulphur pollutants later the interest was diverted to the effect of nitrogen residues. The report has revealed that the pollution levels in terms of both air and water had rose to most significant and dangerous acid deposition on historical monument.

Material and Method

The effect of pH In order to examine the effect of pH of acidic and basic solutions on historical monument. Historical artifact samples were taken from the sample made ready for analysis depending on the amount of sample. The samples were treated with 100 ml solutions with a pH of 2-5 at 25 ^{o}C for one hour. For this purpose, 250 ml cleaned beaker weights (m1) were weighed. Hanna brand pH-meter was used in the preparation of acidic and basic solutions.

Approximately 150 ml of distilled water was placed in a 250 ml beaker. Merck brand H_2SO_4 (d = 1.84) solution was added drop wise to bring the desired pH with the help of pH meter. It was put from the identified samples as described. 100 ml of acidic and basic solutions prepared in pH environments were added on each of them and they were interacted for 30, 60, 90, 120 minutes. At the end of this period, samples were taken with the help of a suitable clamp and washed with distilled water and dried in an oven at 110 ^oC for 2 hours. On the other hand, the solutions were filtered through 12.5 cm diameter, Whatman brand blue tape filter paper. The solutions were filtered and evaluated by spectroscopic measurements.

The analytical supply presented in this report are intended to aid researchers in the assessment of the effects of acidic deposition on building materials after collected-samples phases:

a) The determination of thermal analysis
b) The infrared spectroscopy were made in MTA-Ankara Laboratories
c) Determination of moisture
d) Solubilization of the samples
e) The loss of weight
f) Determinations of pH effect were made in ÇOMU Chemistry Department Laboratory
g) Determination of the effect of temperature was carried out in Kale Ceramic/Semedeli

Finding and Results

When the factors that create acid precipitation in historical artifacts in the province are evaluated: it does not occur as a direct effect of acid precipitation but starts as dry sedimentation accumulation then the effect of acid and humidity. However, the acid effect is minimal. At the same time, it was seen in the thermal analysis tests carried out in the samples taken that the presence of many exothermic reactions was found. Due to the presence of intense UV rays, an increase in temperature occurs due to the release of high energy and it has been observed that water loss occurs in the rocks on the outer wall surfaces of historical artifacts.

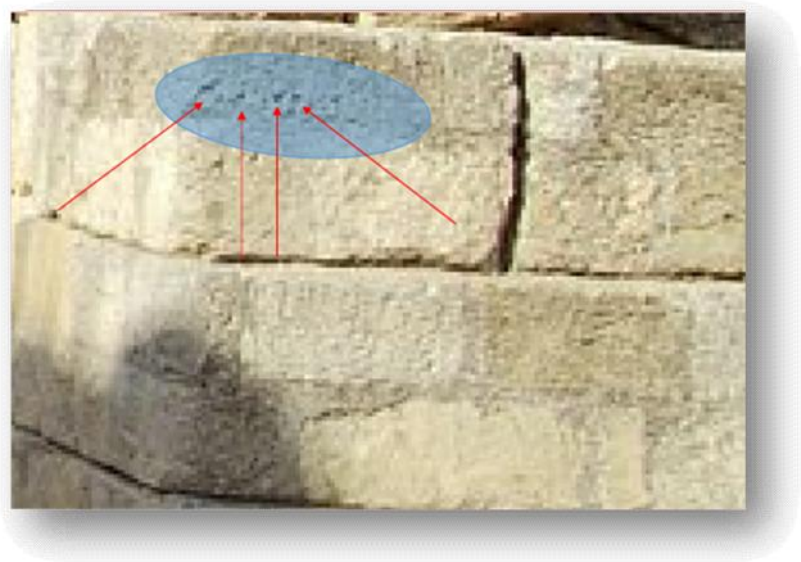

Figure 3. Corrosion caused by acid precipitation on the wall

The determining factor that reduces the effect of acid precipitation in terms of thermodynamics is the resistant type of rock used as building material in Troy's building. Mostly of building material is volcanic and metamorphic rocks used in historical artifacts in Troy. At the same time, it has been determined that these rocks contain intense (69 %) quartz and SiO_2 mineral components.

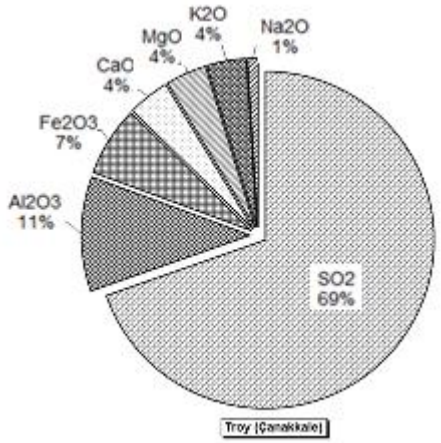

Figure 4. Mineral distribution in Troy' rocks

Temperature and time increase corrosion, It has been observed that the lower the pH value, the higher the corrosion.

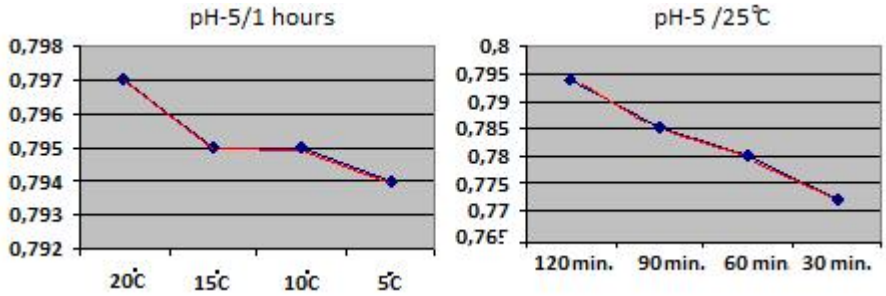

Figure 5. Corrosion effect due to acid variable (time and temperature)

The mineral corrosion on the historical monument concentration because of acidification low values (0.772 ± 0.797 mg) inpH-5 / 25 ^{0}C half hours. Maximum interaction is 0,797 mg during the sampling period in pH-5 / 1 hour by 25 ^{0}C.

Table 1. Acidification variability temperature (5, 10, 15, 20, 25^o C), pH 2-5 and time (30, 60, 90, 120 minutes).

Total	pH-5 / 1 hour				pH-5 / 25 ^{0}C				25 ^{0}C pH4 1 hour	25 ^{0}C pH3 1 hour	25 ^{0}C pH2 1 hour
	20 ^{0}C	15 ^{0}C	10 ^{0}C	5 ^{0}C	120 min.	90 min.	60 min.	30 min.			
0,800	0,797	0,795	0,795	0,794	0,794	0,785	0,780	0,772	0,768	0,780	0,792

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