ABSTRAK

Candi Borobudur yang tersusun atas andesit dan berada di daerah beriklim tropis telah mengalami pelapukan. Pelapukan yang paling terlihat adalah munculnya endapan putih pada permukaan batu. Secara visual, batuan penyusun bagian kaki, tubuh dan puncak candi terlihat memiliki intensitas pelapukan yang berbeda-beda, di mana endapan putih paling banyak terdapat bagian tubuh candi yang ber-relief.

Oleh karena itu perlu dilakukan analisis mengenai karakteristik pelapukan batuan penyusun Candi Borobudur dari segi mineralogi, ikatan mineral, dan komposisi kimia. Analisis laboratorium yang dilakukan meliputi petrografi, XRD, SEM dan XRF. Untuk mengetahui intensitas pelapukan batuan penyusun Candi Borobudur pada bagian kaki, tubuh dan puncak candi dilakukan dengan metode CIW (*Chemical Index of Weathering*) yang selanjutnya dibandingkan dengan CIW andesit segar (CIWn). Kemudian nilai CIW dibandingkan dengan porositas batuan.

Batuan penyusun Candi Borobudur yang berjenis andesit memiliki komposisi mineral plagioklas, piroksen, mineral opak, gelas vulkanik, dan mineral sekunder hasil lapukan. Mineral sekunder yang teridentifikasi yaitu montmorilonit, klorit, hematit dan goethit. Ikatan mineral terlihat mulai merenggang dengan adanya kenampakan bagian-bagian mineral yang terlihat mulai renggang ataupun terlepas. Berdasarkan rasio CIW/CIWn, intensitas pelapukan yang tertinggi ada pada bagian tubuh candi yang ber-relief dengan rasio 1,110 dan 1,139. Berturut-turut di bawahnya adalah bagian kaki candi (1,055 dan 1,077), bagian tubuh candi yang tidak ber-relief (1,056 dan 1,065) dan bagian puncak candi (1,033 dan 1,041). Intensitas pelapukan batuan ini berbanding lurus dengan porositas batuan, di mana nilai CIW semakin tinggi seiring dengan semakin tingginya porositas batuan.

Kata Kunci: relief, andesit, iklim, montmorilonit, porositas

ABSTRACT

Borobudur Temple, which is composed of andesite and is located in a tropical climate, has undergone weathering. The most visible weathering is the appearance of white deposits on the surface of the stone. Visually, the stones that make up the foot, body and top of the temple appear to have different weathering intensities, where white deposits are mostly found in the relief parts of the body of the temple.

Therefore, it is necessary to analyze the weathering characteristics of the stones that make up Borobudur Temple in terms of mineralogy, mineral bonds, and chemical composition. Laboratory analyzes carried out include petrography, XRD, SEM and XRF. To determine the weathering intensity of the stones that make up Borobudur Temple at the foot, body and top of the temple, the CIW (Chemical Index of Weathering) method was carried out which was then compared with the CIW of fresh andesite (CIWn). Then the CIW value is compared with the stone porosity.

Andesite stones forming the Borobudur Temple consist of plagioclase, pyroxene, opaque minerals, volcanic glass, and secondary minerals resulting from weathering. The identified secondary minerals are montmorillonite, chlorite, hematite, and goethite. Mineral bonds appear to be starting to loosen with the appearance of parts of the mineral that appear to be starting to loosen or come apart. Based on the CIW/CIWn ratio, the highest weathering intensity is in the relief parts of the temple with a ratio of 1.110 and 1.139. Respectively below are the foot of the temple (1,055 and 1,077), the body of the temple which does not have relief (1,056 and 1,065) and the top of the temple (1,033 and 1,041). The intensity of stone weathering is directly proportional to the stone porosity, where the CIW value increases as the stone porosity increases.

Keywords*: relief, andesite, climate, montmorillonite, porosity*