



Investigation of the binding materials properties and assessment of durability issue in Fasil Ghibbi palace in Gondar

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ABSTRACT

Conservation of ancient monuments is a process, which will lead to the prolongation of the life of cultural property for its utilization now and in the future. However, before practicing conservation, one must have a broad understanding of the field itself. This is of course to ensure that any action carried out during the conservation work is properly performed and is in accord, not only with the building requirements, but is within the scope of contemporary knowledge of the subject.

Today, these historical structures are in different physical state, some are in relatively good condition, while many are in a deplorable state. The purpose of this research is identifying the method of construction as well recognizing the effect of durability and characterization of the physical and chemical properties of the original binding materials and the newly introduced binding materials used during the restoration of the Royal palace. For this purpose, Mortar samples are taken from Fasil Ghibbi palace, and analyzed in Ethiopian geological survey laboratory using General Silicate Analysis. It includes LIBO₂ Fusion, HF Attack, Gravimetric and AAS.

The type of binding material used during the construction of the Fasil Ghibbi palace is identified as Lime (CaO) or by its local name *Nora*. Moreover, the method of construction was by stone masonry, which tells us a unique combination of Portuguese, Axumite and even Indian influences.

The major cause of deterioration of the Royal Palace is due to various reasons, some of them are the ettringite and/or thaumasite production because of the reaction between sulfate salts and hydrated calcium silicates or aluminates that are present in lime based mortars. Royal Palace is also located on the center of the city; vibration that is prompt by the nearby traffic load is the main reason for tilting of the structural wall. Lack of periodic maintenance; results aging of the palace, unchecked growth of trees, grass, algae & mechanical.

1. Introduction

For the period of several centuries, the influence of several distinct cultures produced rich and diverse cultural heritage that we see today in East Africa countries. The most tangible remains of these heritages are stone built buildings and structures including, palaces, mosques, residential houses and tombs. At present, these heritages are in different physical state, some are in relatively good condition while many are in an appalling condition. The presence of these historical monuments has benefited these countries

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Fig. 1. Buildings in good condition.

economically and culturally therefore, it is essential to ensure that these monuments continue to exist.

Ethiopia, one of culturally rich countries in the world with oldest civilizations and unique geographical features, is situated to the Horn of Africa. Recent studies witnessed that ancestor of the modern human used to live in Ethiopia over three million years ago. Hence the nation has been a cross roads of civilizations and peoples for thousands of years.

Through this long process of civilization and history, quite a number of towns and cities had flourished. Of these, Gondar is a medieval royal city which was ascribed by UNESCO as the " World Heritage Site" in 1978.

The origins of the Royal palace can be found in the old tradition of the Ethiopian emperors to travel around their possessions, living off the produce of the peasants and dwelling in tents. Reflecting this connection, this precinct was frequently referred to as a *katama* ("camp" or "fortified settlement") or *makkababya*, the name applied to the imperial camp in the *Royal Chronicle of Baeda Maryam* (Wikipedia 2014). Gondar is positioned in Northwestern part of Ethiopia, at about 740 and 175 km away from Addis Ababa and Bahir Dar respectively. Its altitude is 2200 m above sea level.

Founded by emperor Fasiladas in 1636, the city of Gondar had been the seat of the Ethiopian state for about 250 years. The foundation of this Imperial city witnessed a period of optimism and renaissance of the golden days of *Aksum* and *Lalibela*. Architecture, literature, education, music, painting commerce that had been perished after the fall of ancient *Aksum*, rose to prominence (Bureau 2011).

The Royal compound lying within 700 m.sq., it encompasses six lofty castles and many different purposed buildings like the royal archive, house of the musicians, the lion cage, the horse zoo, the sauna bath, house of the spinners etc. The earliest and grandest of all edifices is that of Emperor Fasiladas, which is 32 m high and with battlemented square tower (Bureau 2011). Today, these historical structures are in different physical state, some are in relatively good condition, while many are in a deplorable state (see Figs. 1 and 2).

Moreover, due to the existence of these historical structures, this township has become tourist attraction. Due to that, this township and the country as the whole have benefited by promoting their culture and by emerging economical growth. In view of the above benefits, it is essential to ensure that these historical structures continue to exist. Pursuant to this, there is a need to establish the actual conditions of these historical structures with a main purpose of evaluating the possibility of conserving this cultural heritage, which has great historical value and is a potential tourist attraction.

Heritage structures and historical monuments have a central cultural place in any society; old stone bridges, palaces, churches, cathedrals, monuments, etc., nevertheless, degradation processes generated by natural or human actions lead to deterioration,



Fig. 2. Buildings in deplorable state.

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