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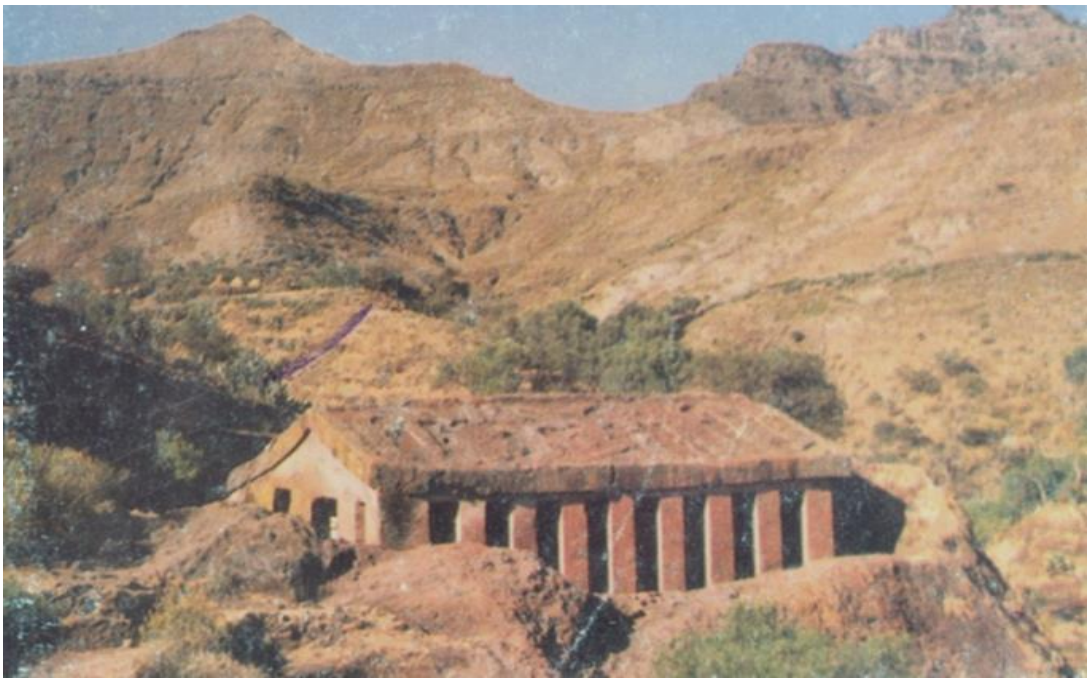
THE CONSERVATION STATUS AND CHALLNGES OF GENETEMARYAM ROCK HEWN CHURCH, NORTH WOLLO.



BY

MOGES TEFERA

A Thesis Submitted to post Graduate Studies of Addis Ababa University.

Addis Ababa University

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THE CONSERVATION STATUS AND CHALLNENGES OF GENETEMARYAM ROCK HEWN CHURCH, NORTH WOLLO.

This thesis is submitted to the Ethiopian Institute of Architecture, Building Construction and City Development (EIABC) and the school of graduate studies of Addis Ababa University for partial fulfillment of all requirements of the Master of Science in Architectural and Urban Heritage Conservation.

BY

Moges Tefera

Advisor: Tadese Girmay

June, 2022

Addis Ababa

Addis Ababa University

Post Graduate Studies

This is to certify that the thesis prepared by Moges Tefera, entitled ;The Conservation Status and Challenges of Genetemaryam Rock Hewn Church, North Wollo, and submitted in fulfillment of Master of Science of Architectural and Urban Heritage Conservation complies with the regulations of the university and meets the acceptable standards with respect originality and quality.

1.	Tadesse Girmay	_____	_____
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	Chairperson	signature	date
5.	_____	_____	_____
	Graduate Program Director	signature	date

DECLARATION

I declare that, thesis entitled as, “The conservation status and challenges of Genetemaryam rock Hewn Church, North Wollo.” is original work of my own, has not been presented for a degree at any other university and that all sources of material used for the thesis have been properly acknowledged. Moreover, I understand that non-adherence to the principles of academic honesty and integrity, misrepresentation or fabrication of any idea ,data and fact will constitute sufficient ground for disciplinary action by the University.

Name of candidate: Moges Tefera

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CONFIRMATION

This thesis has been submitted for examination with my approval as institute’s advisor.

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ABSTRACT

Genetemaryam is endowed with rock-cut church embodying architectural significance. However, this priceless cultural Heritages is frequently confronted with different threats. It is increasingly deteriorating and threatened by a host of both natural and anthropogenic factors. This will result in loss of the authenticity and beauty. The church is subjected to different problems such as cracking, degradation and breaking that badly affected its values.

This church was carved in the late 13th century. Since then, it has been exposed to wind, rain and thermal changes as well as to the impact of human activities. This has resulted in severe degradation of the church which is considered to be in a critical condition. It is also evident that all the identify phenomena and related causes are strictly connected each other and they mutually contribute to the amplification of some degradation effect. Identifying the nature and scale of destructive forces helps to determine intervention methods. It also enables to take measures before it results in total loss of the heritage. This paper is designed with the objective of assessing the untapped potential and existing problems of this cultural heritage. Finally the study concluded with some of the conservation measures which should be undertaken to solve the problems in this church.

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LIST OF ACRONYMS

AC: Athens Charter**.**

AHM: Archaeological Heritage Management.

ARCCH: Authority for Research and Conservation of Cultural Heritage.

CHM: Cultural Heritage Management.

CRM: Cultural Resource Management.

ICCROM: International Conservation Center for Restoration of Monuments.

ICOM: International Council of Museum.

ICOMOS: International Council of Monuments and Sites.

ICAHM: International Committee for the Management of Archaeological Heritage.

IFM: International Fund for Monuments.

IUCN: International Union for the Conservation of Nature.

UN: United Nation.

UNESCO: United Nations Educational, Scientific and Cultural Organization.

WMF: World Monument Fund

WHS: World Heritage Site.

CHAPTER ONE

1.1. GENERAL BACK GROUND OF THE STUDY

Genetemaryam is amongst the most important heritage sites in Ethiopia. Its historical, architectural and cultural significance is unparalleled. It is also increasingly important economically as a major tourism destination. But despite its significance, the physical condition of this church is a cause for serious concern. Structural instability affects the church, and erosion is destroying the site's historic character. There are number of factors which lead to physical deterioration of this church. Recycling rainfall and sunlight, among others, are the major natural factors that caused deterioration or destruction of this rock hewn church. Degraded original pillar from the inside and outside of the church seems not able to support the thick roof above it much longer. Soils formed on the roof of the church are indicative of seriousness of deterioration process. In addition to this, traces left by rain water on roof, ceiling and walls of the church especially before the construction of the shelter was indicate high concentration of salt. Cracking on different parts of this churches is another factor which causes physical deterioration. It could be vertical or horizontal but the effect of such acts in reducing aesthetic value of the churches is enormous.

This church Betelhem* was highly affected from flood and raindrops seeping through its roof. Because this part of the church was not covered by shelter. Rain water and resultant flood, weathering and biological causes of destruction are the most threatening natural cause. The Wall paintings are an integral part of this church and should be preserved in situ. Many of the problems affecting wall paintings are linked to the poor condition of the building or structure, its improper use, lack of maintenance, Substandard and inadequate practices and unprofessional qualifications have led to unfortunate results. (ICOMOS Principles for the Preservation and Conservation-Restoration of Wall Paintings 2003).

*Betelhem: it is parts of the church and a preparation room for the priest before the mass program starts.

Destructions related to maintenance and other conservation activities are the other factors which lead to physical deterioration of this church. In this, cracks are filled with mud without any preliminary study by the priest themselves. Besides physical deteriorations, such type of restorations also affects aesthetic values of the church. Above all, the absence of governmental attention towards heritage conservation is costing the country with a profound loss of its incredible rock hewn heritages. Tourist related problems are other forms of deterioration in this church. For instance flash cameras are not allowed where the church are full of wall painting. Besides this, In this regard high carrying capacity has also its own impact especially during the high season.

All the evidences presented in this study are indicators that the study areas cultural heritage management is at its critical situation which needs the engagement of concerned stakeholder to preserve the country's past. Where heritage is a source of substantial economic benefits, it is essential to manage pressures that result from heritage related development through a sound governance structure that puts heritage conservation at the 'front and center' (The Getty Conservation Institute, 2010). Managing heritage successfully requires the effective integration of a wide range of complex and inter-related management considerations, arising from within and outside attraction (Fyall, et al., 2008).Factors related to human pressure on heritage sites include: poor handling system of treasures, lack of documentation, lack of awareness, lack of security personnel and illicit traffic threaten and destroy the church treasures with in the church Eqabt*. This study was also held to identify all these major heritage potential and challenges that are faced and requiring attention in this study area.

1.2. GEOGRAPHICAL LOCATION OF THE STUDY AREA.

Genetemaryam, the 'paradise of Mary' is to the south east of Lalibela, via the old lalibela-woldya road and 27 kilometer (one hour) drive mainly on dirt roads. It is also located at a distance of 680 km. from Addis Ababa.

*Eqabet: a place where church treasures are placed in and kept.

According to the church fathers, this church believed to have been built by Emperor Yekunuamlak in the late 13th century. He was the first ruler of the Solomonic Dynasty that succeeded the Zagwe. The area is known for rock churches widely distributed in mountainous land scape (Heldman 2015). The area is bordered to the North by Waghimera zone, to the south by Gashena, to the East by Muja and to the West by Bugna woreda. The Geographical setting of Genetemaryam is highly dominated by uplands which range from 4190 to 1595 m. a. s. l. It has moderate mean annual temperature i.e. 19 0c.The mean annual rainfall is 765 mm,

Figure 1 Geographical map of the study area (from goggle map.)

While 890 mm and 570 mm are the highest and the lowest annual rain fall. The area has two rainy seasons from June to September (big rains) and from March to April (small rains) (Lasta Woreda Communication Office

Report2019).Genetemaryam is home of various plant and animal species which are found in wide ranging geographical and environmental settings.

Mount Abune Yosef is playing an important role in preserving huge number of plant and animal species identified with the area. Monkey, ape, rabbit, tiger and others are found in this place. Most of the uplands in the area are not covered with vegetation which resulted in over grazing and soil erosion. Though rehabilitation activities through public participation in recent years improved the situation, well-organized and focused soil management and environmental protection tasks is crucial. There are number of seasonal and non-seasonal rivers, swamps and springs. Tekkeze and Kechin Abeba, are the largest and non-seasonal rivers which are widely used for irrigation purpose.

1.3. Statement of the Problem

Genetemaryam is rich in variety of heritage aspects which need to be conserved and transferred for the benefit of future generations. Heritage management is also explicitly being considered as one of the development options for remote and isolated areas like Genetemaryam. However, heritage management is not clearly studied and identified as a capable development option in Ethiopia.

Despite growing interest in investigating heritage management potentials and challenges in the country, the efforts made to study them are prevented largely by lack of financial resources and professionals qualified to study them. There is no any effort made by foreign researchers or Ethiopians, which brought about better understanding of this heritages. Even though the rock hewn church of Genetemaryam was slightly mentioned in some literatures with other Lasta rock hewn churches, it is hardly possible to consider the studies as organized researches in a way they give complete picture of rock churches in the area.

The study area is among the notable cultural heritage destinations in Ethiopia with its ample religious activities. Heritages like annual religious festivals which are centuries old and its live rock-hewn church and culture. However, problems such as factors related to human pressure on heritage sites include intensive agriculture

and deforestation, looting, neglect, conflict, as well as weak economic conditions can threaten and destroy this heritage site. Besides this, luck of conservation and restoration work in this church, in adequate security system, lack of local participation and others are expressed as threats to this rock hewn heritage. Therefore, heritage potentials and challenges have hardly been studied at all in Genetmaryam. This study was held to identify these major heritage potential and challenges that are faced and requiring attention in this study area.

1.4. RESEARCH QUESTIONS

This study attempts to answer the following questions:-

1. What are the major deterioration agents of this rock hewn church?
2. What are the major challenges of the church treasures in this church and?
3. What conservation Measure should be taken to alleviate those problems?

1.5. OBJECTIVE OF THE STUDY

1.5.1. GENERAL OBJECTIVE

The main objective of this study is to show the conservation status and major challenges of Genetemaryam rock hewn church.

1.5.2. SPECIFIC OBJECTIVES

The study intend to:-

1. Examine heritage conservation activities on the sites,
2. Assess the existing condition of the church treasures with in the church and
3. Identifying the major conservation challenges in this rock hewn church.

1.6. SIGNIFICANCE OF THE STUDY

In the absence of full Conservation Project Work and Studies in the area, it will create understandings of heritage potentials and its major challenges of the area.

The study contributes as a source of information for visitors, policy makers, the public and the academic community.

The study will demonstrate the deterioration level and the level of the conservation intervention in the previous times in this church. The findings will also use as an imput to formulate a working recommendation to safeguard the heritage from future inappropriate conservation interventions; to slow down further deteriorations and to plan the way forward for future conservation engagements.

This research on rock church of Genetemaryam in the area will be a contribution to the existing studies focused on other churches.

It provides a well-studied and organized documentation as bridge of knowledge transfer for the next generation and a possible guidance for the need of conservation, which is a major current issue.

The methods used and the results obtained may also provide an important base for further research on these and related areas.

1.7. SCOPE OF THE STUDY

The scope of this study is limited to the investigation of the rock hewn church of Genetemaryam and to study the heritage potentials and its Major challenges for sustainable development. In addition the study assessed conservation measures which should be taken to mitigate the problems.

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1.8. LIMITATION OF THE STUDY

Although this study has yielded some findings, it is not without constraints. The sudden occurrence of covid-19 pandemic disease above all lack of budget and war with in the country were the major factors encountered in the process of producing this thesis. There might be an attempt made to get necessary data is significantly influenced because of unwillingness of church official to grant permission to visit inside the church. For instance, they don't allow to take picture and to see sanctuary (mekides) of the church. Discussion of sanctuaries is totally depended

on data from informants (church officials) and literatures. The study area is also remote and in accessible.

1.9. RESEARCH METHODOLOGY

In general, the methods to be employed to achieve the objectives of the study are:-

1.9.1. LIBRARY AND ARCHIVAL MATERIAL WORK

Electronic and printed literature related materials to the study are reviewed before and after field work. This secondary database includes the data retrieved from different culture and tourism office documents from woreda to federal levels.

1.9.2. FIELD WORK

Fieldwork largely comprises the visit on the churches and the data collected through direct communication of the researcher with stakeholders. In rock hewn heritage studies researcher is not expected just to observe from a distance but to participate actively and experience interaction with rock hewn features, because they can only be understood in depth through active physical interaction and continuous dialogue (Drewett 2001.)

The data regarding the rock church are result of close observation of internal and external elements of the churches. Taking pictures and videos of the churches and other important features and festivities are the tasks I conducted as part of fieldwork.

1.9.3. INTERVIEW

This technique is used to collect data from informants who have direct relation with the churches i.e. employees of Tourism Officials, tour guides, hotel managers, priests, and local residents.

While unstructured interview was used to collect data from local residents and a guide, data collected from Culture and Tourism office and Church administrators at each church involved both structured and unstructured interviews.

1.9.4. Methods of Data analysis

Analysis was done in two ways. Few and selected numerical data was organized into tables and the result was described and explained based on the nature of the data. On the other hand qualitative data collected through observation and interview was analyzed by combining hem the data collected through review of different literatures and documents from the government office.

1.10. ORGANIZATION OF THE THESIS

While Chapter One deals with the general back ground and organaization of the thesis,Chapter Two discuss with the rock church, its conservation with a focus on previous interventions.Chapter Three deals with conservation measures.In Chapter Four the issues of the Current condition of the church is addressed and Chapter Five Discussion on findngs of the research and Chapter Six Conclusion and Recommendation of the study.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURES.

2.1. CONSERVATION.

2.1.1. THE PURPOSE OF CONSERVATION.

Following the spirits of the International Charter For conservation and Restoration of Monuments and Site (The Venice Charter 1966) many nations around the world devised their own respective charters to set out principles to guide the conservation of places of cultural heritage value. These charters are intended to serve as a frame of reference for all those who, as owners, territorial authorities, trades people or professionals, are involved in the different aspects of such work. These are aimed to provide guidelines for community leaders, organizations and individuals concerned with conservation issues. The purpose of conservation is therefore, to care for places of cultural heritage value, their structures, materials and cultural meanings. The cultural heritages are inseparable from the identity and well-being of the people who made or used them and have particular meanings.

2.1.2. THE DEGREE OF INTERVENTION IN THE PROCESS OF CONSERVATION

The degree of intervention and the scope of replacement of old features with new ones vary with different practitioners in different countries. Some take conservation to a level where replication of the whole structure of the old heritage while others do not consider replication works of the whole structure as one means of conservation methods.

Conservation may also involve, in increasing extent of intervention: non-intervention, maintenance, stabilization, repair, restoration, reconstruction or adaptation. Where appropriate, processes may be applied to parts or components of a structure or site.

Non-Intervention: is to mean than assessment may show that any intervention is undesirable. In particular, undisturbed consistency of spiritual association may be more important than the physical aspects of some places of heritage value.

Maintenance: this is to mean that a place of cultural heritage value should be maintained regularly and according to the plan, except in circumstances where it is appropriate for places to remain without intervention.

Stabilization: places of cultural heritage value should be protected from processes of decay, except where decay is appropriate to their value. Although deterioration cannot be totally prevented, it should be slowed by providing stabilization or support.

Repair: repair of material or of a site should be with original or similar materials. Repair of technically higher standard than the original workmanship or material may be justified

Restoration means returning the existing fabric of a place to a known earlier state by removing accretions or by reassembling existing components without the introduction of new material.

Reconstruction means returning a place to a known earlier state and is distinguished from restoration by the introduction of new material into the fabric.

Where the life expectancy of the site or material is increased, the new material is compatible with the old and the cultural heritage value is not diminished. New material should be identifiable.

3.2. General survey of Conservation problem around Genetemaryam church.

Lasta is endowed with incredible rock-cut churches embodying great architectural significance built over its past.Besides Genetemaryam rock hewn church,many others rock hewn church found in lasta,like Bilbala Qirqos,Bilbala Giyorghis, Sarzna Mikael,Kenkenit Mikael Asheten Maryam, Emmekina Lideta and many other churches too. However,these cultural heritages are increasingly deteriorating

and threatened by a host of both natural and manmade factors. Problems such as cracking, degradation, breaking and demolition that badly affected their significant values. (Firdyiwok, 2012).Uninformed local intervention one of the major manmade factors, not only has failed to restore lost structural and architectural elements of the rock-cut churches of Lasta, but it also has replaced original rock-cut features. This is witnessed in Bilbala Qirqos church. War and conflict by Ahmmed gragh for instance were also the other man-made causes of damage in Blbala Giyorghis church.

According to ICCROM (1978) it is opinion of authors that the cracking due to whatever cause is of secondary importance to the phenomena associated with water. The presence of basalt is integral in the deterioration, as it forms an impermeable membrane through which water cannot penetrate. A structure built on basalt will absorb the water lying directly on top of basalt. Alternate wetting and drying of the scoria will result in damage of the rock surface. In the case of salts, this resulted in changing the color of the rock in to white natures and finally leads to disintegration of the rock. This is mostly observed in Arbatu Ensesa churches.

Fig 2: The effect of salt in the church of Arbatu Ensesa at its roof. (Source Lasta woreda Culture and Tourism Office.)

According to ACEL & SAVA (1997) the mineralogical composition of the basic tuff, out of which the churches are carved, its lithological characteristics and its tremendous high surface area exposure to the outer environment are the basic

factors accelerating weathering processes. Weathering due to hydration and cyclic hot and cold air temperature leads to easy decomposition of feldspar mineral constituents. As a result wall and roofs elements of the churches have started to pill off since long period of time before present. Together with this biological colonization play a relevant role in churches like Kenkenit Michael and other churches too. According to our forefather, In Kenkenit Mikael church a big olive tree were grow on its roof of this church, they consider the tree as like parts of the church and leave the tree for long years which finally resulted in partial collapse of the church.

Fig.3.Partial collapse of the church of kenkenit Mikael due to big tree grow on its roof. (Source Lasta culture and tourism office)

Weathering can be identified as a major nature caused factor of deterioration in those churches. Disintegration the rock is resulted from wetting and drying cycle. The effects of weathering are observable in the churches like Sarzna Mikael and Bilbala Giyorghis churches.

The geography where the churches are located, without doubt, helped preservation of the churches. The churches that better survived the destructive forces of nature and human intervention are those built in caves. Churches like Emekina Medihanialem, Emmekina Lideta Maryam and Saint Nakutol'ab church are cave churches which are relatively better conserved.
On the other hand, most of the rock hewn churches are severely deteriorated largely by natural cause of deterioration. Conscious and unconscious acts of people also continued threatening cultural heritages. Cracking on different parts of the churches is another factor which causes physical deterioration. Cracking are evident in almost all of rock hewn churches of lasta .The effect of such acts in reducing aesthetic value of the churches is not taken seriously.

Figure.4: The in accessible Cave built up churches of Emekina Medhanialem (lasta culture and tourism office.)

Tourist related problems are other forms of deterioration in Lasta rock churches. For instance, flash cameras are not allowed in all church where the churches are full of wall painting. This is true in Emmekina Lideta Maryam church. For this, uniformly and reasonably applicable rules results sound management and conservation of the heritages, which in turn ensure sustainability. The community

related to the churches used, managed and renewed the churches for many generations. These people are more than just another stakeholder group in protecting the heritages. Connection to heritages or place is an important part of people's commitment to protect heritage places and values. However, Destructions related to maintenance and other conservation activities are the other factors which lead to physical deterioration of the churches. In churches like Asheten Maryam, Bilbala Qirkos and Emekina Medihanialem cracks are filled with mud without any preliminary study. In fact maintenances like this are done by the local people. Besides physical deteriorations, such type of restorations also affects aesthetic values of the churches.

According to (Delmonco et al 2010) pedogenesis resulted from raindrops on roof of churches is dominant cause of degradation of roofs of churches like Arbatu Ensesa churches in lasta. The same process coupled with biological factors resulted deterioration of roof and other parts of the church. Soil formed through such process is evident on the roof of this church and it provided favorable condition for growth of plants. Scientific methods are not used to remove plants grown on churches.

Figure 5: Highly degraded churches of Arbatu Ensesa (Source Lasta culture and Tourism office)

Churches like Arbatu Ensesa and Sarzina Mikael are highly affected from flood and raindrops seeping through its roof and walls of the churches. In all rock churches of Lasta, water caused deterioration is critical. In this regard, Sarzna Mikael needs special care and treatment. As indicated above the church had gone through maintenances. But it remained under critical condition as seeping through the roof is causing destruction of pillars (inside and outside) of the church. The current look of eastern façade and part of the southern side of the church are result of the previous renewal. Degraded original pillar from the inside and outside of the church seems not able to support the thick roof above it much longer. Soils formed on the roof of the church are indicative of seriousness of deterioration process. Cracks on the walls of the church are also sever compared to other churches. In this church, Traces left by rain water on roof, ceiling and walls of the church indicate the porosity nature of the rock and high concentration of salt.

In general, the identified effect of chemical/physical degradation in most of the study area of lasta includes:-

1. Mechanical erosion produced by rain drops;

2. Those churches is exposed by vegetation and plant roots action; this a particular severe problem where there is limited thickness of roof and the nature of the rock type; e.g. the partial collapsed church of kenkenit Mikael church.

3. Water infiltration from existing rock and weathering of strata also due to the porosity nature of the rock type in sarzna Mikael church;

4. Limited carrying capacity of some walls, due to the very heavy load to sustain; this is mostly the case of Bibala Giyorghis church during its annual celebration day.

It is also evident that all the identify phenomena and related causes are strictly connected each other and they mutually contribute to the amplification of some degradation effect.

3.1. GENETEMARYAM ROCK HEWN CHURCH.

Genetemaryam is a monolithic rock-hewn church. But, unlike those in Lalibela, the red tufa of its roof projects sufficiently above its surrounding trench walls so that it is visible at a distance. In this church, the whole wall has been excessively painted on plaster. The pictures are true frescoes and date to the late 13th century. Unfortunately, the colors have faded, and the plaster has peeled off in many parts of the church. The figures in the frescoes are very distinctive.

3.3.1. Present condition of the church

Genetemaryam is among the most important heritage sites in Ethiopia. But despite its significance, the physical condition of this church is a cause for serious concern. Structural instability affects the church and erosion is destroying the site's historic character. According to the church fathers, from the 1960s on wards different work was completed like conservation and construction of shelters in Genetemaryam church as a temporary solution which was funded by the Authority for Research and Conservation of Cultural Heritages in collaboration with the local culture and tourism office. But the shelters are at best only a partial solution, doing nothing to address structural weaknesses and nothing to solve the whole problems of the church. Visually, the shelters are extremely disturbing, entirely altering the intrinsic values and experience of the site.

2.4. PROBLEMS WHICH CHALLENGES THE ROCK HEWN CHURCH OF GENETEMARYAM

Generally, the rock hewn church is highly is affected by different agent of deteriorations. Problems like stone deterioration, erosion, salt, structural problems, cracks of both large and small scale and missing parts are all detected in this church. The growing of lichens, Moses, and small algae on its courtyard is also noted. All these factors together resulted in surface deterioration manifested in the appearance of the rock. These all challenges are described below.

A. STONE DETERIORATION

The main damage phenomenon for this was rainfall followed by wind erosion, biological growth mainly due to lichens and algae and salt decay connected with moisture are another factors. These deterioration mechanisms will led if not proper measure take to its final collapse. The effects of temperature changes on the surface of the rock is another mechanism for stone deterioration. When the surface of the rock is overheated by the sun, and then cooled down by a sudden shower, the rock undergoes become weak and weak. Which produces superficial scaling and exfoliation over time. They are all influenced by the mode of weathering of their environment. (Ruedrich et al., 2011; Sigismund and Snethlage, 2014).

Figure 6: Damage Rock Due To Weathering (source the author)

B. BIOLOGICAL COLONIZATION

The biological degradation of rocks is well known and has been studied for a long time it is one of the weathering mechanisms responsible for the formation of soil. The deterioration of stone in buildings and monuments through the action of biological organisms has also been acknowledged since the mid-1960s, but the topic has received increasing attention over the past decade. (Eric Doehne and Clifford A. Price 2010).

A massive growth of lichens, mosses, algae and tree has been observed in the church mostly at its courtyard and the church Betelhem. Mosses appear to do the most harm and need wet or damp areas in which to spread. The main cause for the runaway growth of mosses is the water that accumulates during the rainy season and through capillary action invades the porous rock, facilitating its structural deterioration from within and permitting mosses to cover the surface. Ethiopian authorities like the ARCCH, have been investigating the possibility of using herbicides to control the mosses, but will not use them until environmental impact studies have been carried out. The growth of roots and branches of the plants on and around the church can crackdown, break and loosen stones and large fragments of the rock due to natural factors. Once plant grow on the rock it will deepen its root inside the rock which finally resulted in its total or partial collapse. Beside to their direct impacts, the plants (the trees and shrubs) grown in and around the monuments allow infestation of animals such as rodents that cause mechanical damages while they dig the monumental grounds to make their habitats within the structures.

Figure 7, the growth of plants and trees in the court yard of the church, (source the author)

The small trees and grasses are affecting the structures by creating algae and fungi (Biological agents). In this case, it is common in the court yard of the church. If it is not cut without any doubt will damage the church soon.

According to Carmen Portillo and Juan M. Gonzalez, A careful study of potential physical, chemical, and biological deteriorating factors is required to guarantee the ideal conservation strategy. From the microbiology perspective, the microbial colonization of stone may result in damage to monuments. Microorganisms are numerous and diverse. Their action on stone substrates may not be fast, but in the long-term their effect may be important. Because stone monuments cannot be sterile, at present, a promising Strategy for stone conservation is to reduce or eliminate microbial unbalanced or massive growth.

Each of these types of biological growth can cause damage through either physical or chemical means. Physical weathering results from the mechanical action of the organism digging beneath the surface and removing the mineral. When moisture is retained in the organism's 'root' structure and freeze or dry cycles occur, the ensuing expansion and contraction forces exacerbate this mechanical action. On the surface, deposits of biological growth can block the stone's pores and prohibit the natural flow of water, thus contributing to any weathering or exfoliation of the surface in the church. (Carmen Portillo and Juan M.)

C. SALTS

Along with weathering, soluble salts represent one of the most important causes of stone decay. Salts cause damage to stone in several ways. The most important is the growth of salt crystals within the pores of a stone, which can generate stresses that are sufficient to overcome the stone’s tensile strength and turn the stone to a powder. The deterioration of many of the world’s greatest monuments can be attributed to salts, (Siedel, von Plehwe-Leisen, and Leisen 2008).

The salts, as discussed earlier, constitute probably the gravest threat to the integrity of the rock. The most damaged areas all show the presence of hygroscopic salts, which-in combination with humidity- are known to be one of the most destructive agents in weathering and breaking down of stone. The salt change the color of the rock in to white nature. Finally it will lead the rock to lose its original design and shape. The effect of salting can be easily shown in the southern parts of the roof of the church.

Figure 8: The Effect of Salt in Genetemaryam Church in its Betelhem and southern faced of the church. (Source the author)

D. EROSION

Loss of original surface, leading to smoothed shapes is known as erosion (ICOMOS- ISCS stone glossary, 2008).In case of Genetemaryam rock hewn heritages, surface erosion, characterized by the breakdown of the rock clays or other minerals, is one of the most abundant forms of deterioration visible on both internal and external facades of the church. Erosion of the surface can take place due to a variety of natural or anthropogenic causes and the actual mechanism can be due to chemical or physical processes. The erosion is not uniform in all the carved stone blocks and some of them show more severe form of erosion than the others, which indicates that it may be the result of inherent material properties and their response to external environmental factors. The most important reason for surface erosion in this rock churches is an access of large amount of rainwater and cycles of wetting and drying. The wetting of sandstones leads to volume increases of the material and to heterogeneous stress accumulation within the stone, which leads to disintegration (Ruedrich et al., 2011; Sigismund and Snethlage, 2014). The combined effects of swelling and the crystallization of salts

have led to erosion of carved details from the surfaces of several stone blocks. (Fig.17.)

Figure 9: Eroded Part of the church due To the Weathering Process (source the author)

E. THE WEATHERING PROCESSES AND CAUSES OF DAMAGE TO THE CHURCH.

Several combined reasons that cause physical and chemical decay in the hewn rock, and their interrelations have been identified: characteristics of the basalt and tuff, evaporation of salts, decomposition of the rock, heavy weight of hewn roofs versus a lighter bearing capacity of the walls, dilatation of the large monolithic structures, mechanical erosion produced by rain drops, tuff stone alteration due to climatic factors, discontinuities in the rock geological formation with direction and dip capable to generate a sliding, etc.(Leisen 2008). Further studies should be undertaken to reveal the progress in understanding the precise causes of decay, but still need to be deepened and improved. Tests still need to be done systematically to fully analyze the decay related to the geological, geophysical and chemical properties of the hewn rock. In addition, the humidity rates inside the churches should be analyzed and monitored.

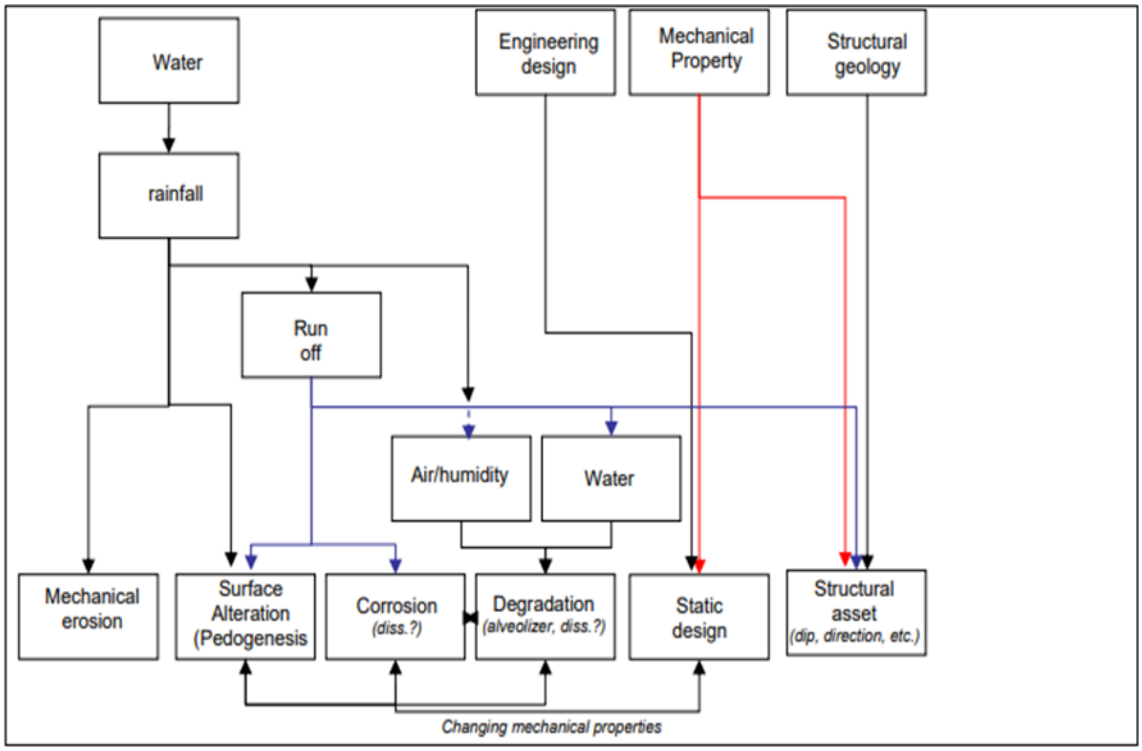


Figure 10: Chemical and Mechanical Degradation Phenomenon of Rock Churches and Possible Causes. (Source Claudio Margottini.)

F. STRUCTURAL PROBLEMS

Based on my observation, the most critical structural problems have been identified in this church where an imminent risk of collapse is possible in the near future. Immediate studies and remedial measures need to be undertaken especially at its eastern part in the corner of the pillars and the roof of the church. The sliding problem seems too far, but necessitates further monitoring and, if needed, consolidation measures especially inside the pillar and of the church. In Genetemaryam, structural investigation is necessary to determine if the past structural failures have stabilized or are still active. To define the appropriate solutions, detailed studies of the structural behavior need to be undertaken and a monitoring system installed in the pillars and roof part, also systematic structural assessment should be done in the holy of holies.

Figure 11, Crack at its roof part of the church, (source the author)

G. WALL PAINTINGS AND SCULPTURES

The current situation on this site is it is evident that serious deterioration of the paintings in the church has occurred due to natural and many other factors. The paintings properties and decay factors should be thoroughly studied in order to define restoration solutions. The study should include historical research, detailed survey and recording of the wall paintings as well as sample analyses to identify the composition of the wall paintings and their decay pattern. Sample consolidation and restoration tests should be performed. Sculpted elements have the same dilapidation pattern of the tuff out of which the church are hewn. Although sculpted windows are exposed to rain and wind, these are slightly damaged in general. However, sculptures and bas-reliefs (like the ones at the entrance of Genete Mariam church) were severely damaged in those previous years, and their original

features are hardly recognizable. These elements should be surveyed and restored following historical research, a detailed survey and recording, and an analysis of their decay pattern in order to define a restoration action plan. Nevertheless, conservation studies and works will concern the protection of paintings and sculptures from already identified decay factors. Marya j. and BobF. (2015)

Figure, 12. The plaster are peeled off in many parts inside the church (Source the author)

The Church is adorned with fresco paintings. Wall paintings are an integral part of monuments and sites and should be preserved in situ. Many of the problems affecting the church wall paintings are linked to the poor condition of the building, its improper use, lack of repair and maintenance.

Deterioration problems observed on the wall paintings of the church is loss of plaster and painted layers. Total loss of plaster layer is common type of deterioration in rock hewn architectures. Both manmade and natural causes are evident. People visiting the church and those enter to the church during services

unconsciously destroy paintings. Paintings on columns and pilasters of churches mostly are deteriorated this way. Church materials like “drum and praying stick”, electric installation, chairs and other materials are placed near columns play the largest part of destruction as human cause of destruction in many churches. Such materials deteriorate paintings when they are moved from place to place. On the other hand, deteriorated plaster on a column in this rock hewn church are the water seeping through roof and walls of buildings take the largest part as natural cause of destruction especially before the construction of the shelter. Plaster layers are continuously flicking off from walls and ceiling of the churches as a result of water agency as a factor of deterioration. (Mariam. and Bob,F.(2015.)

Figure 13: Damage of Wall Painting in the Church (Source the author.)

H. NEGLIGENCE

Negligence is perhaps the most dangerous threat, this could be through deliberate intent, lack of awareness or concern, or lack of the necessary resources. This is mostly the case for the decision making body who are in the higher authorities. It

is not only the failure to undertake necessary work on cultural heritages; it can also consist of failure to develop appropriate legislation, the failure to observe incompatibilities between different legal measures or policies, or the failure to undertake necessary research into preventive and remedial measures by whom with profound proficiency in the field. In short, it is the result of poor attention from all the concerned bodies (local to the federal level.) Even, the growing of algae, fungi and lichens on the rock surface is the result of lack of awareness and concern by the local communities.

I. IMPROPER CONSERVATION

Conservation is a problem if we are failing to do it properly. In one way or another we can easily see this effect in most churches of the country. There is a shortage of well trained and experienced expertise in the field of conservation with in the country. It also needs great skills in the field with adequate experiences and if we are doing faults in conservation it is dangerous for the heritages; because heritages are irreplaceable human resources once we have lost them. There should not be trial and error on heritages during conservation work. If possible it should be well planned and executed with the principle of reversibility.

Figure14, Improper Conservation Work at the wall of the Church. (Source the author.)

The restoration of heritage required skilled personnel to undertake intervention. The architect who led the work should have specialized skill and knowledge in conservation. Trained conservation architect is expected to have deep knowledge of the process and technique by which the materials, historical design integration of heritage structures could persevered without losing their aesthetic and original character. Masons, artisan and other skilled personnel who are familiar with heritage protection would have to be readily available. During the work, it is also important to have knowledge and skill transfer for the local expertise to make the work sustainable.

J. LACK OF ADEQUATE FUNDS

Historic Sites and Monuments in Ethiopia, such as Genetemaryam, that are crucial to the country's heritage are under threat because of a sever lack of funds to preserve and maintain them. Funding issues take the highest share of the problem. It is the most basic issue in safeguarding, promoting and conserving the heritage for cultural tourism development.

Restoration work needs plenty of time and financial resources. Mostly the heritage conservation and restoration work are funded by the local government, the authority of research and conservation of cultural heritage (ARCCH) and by few volunteers like UNESCO and WMF. The local community give free labor services and sometimes material support during conservation work. Most of the heritage in Ethiopia are very old and are damaged by both natural and manmade factors. Almost all are at alarming stage.so the government should allocate adequate funds to sustainably maintain.

K. LACK OF COOPERATION WITH THE CONCERNED BODIES

Heritage by its nature needs multidisciplinary study and cooperation of all the concerned bodies for its proper up keeping. Professionals from different field of studies, individuals, governmental and nongovernmental institutions, religious institutions, and even now countries from different corner of the world is expected to cooperate for the sustainable conservation and management of heritage sites.

However, the fact in the study area is the reverse. All the concerned bodies are not cooperating in preserving of this heritage site. Tourism offices at different levels and the church officials, are not working as such as it is expected. For example, the church and the tourism offices at the local level are not always consulting the heritage professionals and heritage conservators and managers are also failing to cooperate with the stakeholders of the heritage. So, it is a serious issue that all

concerned bodies should think about it. Generally the damage occurred in the churches can be grouped in to two.

A. Natural Factors

High rainfall followed by dry and hot weather have contributed to the deterioration and destruction of the rock hewn churches. Rainfall which comes in the summer months have damaged different parts of the rock. The mixture of water and rock components cause salt crystallization threatened the integrity and thickness of the rock. Salts are soluble and can dissolve and recrystallize, often within the pores of the stone at the point of evaporation. Water that has salts can move through the stone in different ways, depending on the wetting and drying conditions. (Margottini, C. 2005.)

Due to the heavy rainfall experienced in the area, water is collected on the roof and drops through the cracks and pass in to it the action further aggravating the deterioration. The heavy rainfall during summer season is followed by the cold and dry winter temperatures which causes the cracking and fracturing of the exterior part of the church. Despite the local communities' attempt to repair the exterior of the church at different times this has not slowed down the deterioration as there is no conservation protocols for preserving the rock hewn churches. The impact of these threats is serious on every façade where almost all the architectural features are extremely eroded. The impact of climate is less on the other facades of the church. Water that collects on the roof has an impact on the integrity of rock wall. In this church different part have lost their aesthetic features as a result of the effects of rain fall.

There is also fracturing of wall at its roof and at different parts of the rock hewn church. The problem is increasing from time to time and the profound impact of high rainfall is evidenced since many years ago.

B. ANTHROPOGENIC FACTORS

Uninformed reconstructions are also a major contributor to problems that are faced by many rock hewn architectures. The lack of collaboration between the local communities and professionals in the process of intervention has resulted in new materials being used. Basalt instead of sandstone has been used in repair work and this has been mortared with cement in Genete Maryam church**.** This has not only caused further structural problems but has also changed the aesthetics of the church. Most of the reconstructions are immediate reactions to an immediate problem caused by the rain. The repairs have not been effective as the western roof still leaks. The repairing work has negatively affected architectural values of the monument. The lack of support from government in providing conservation professionals as well conservation guidelines has led to haphazard methods being tried causing the structural problems as well as changing the aesthetic values of the church.(Clifford A.2010.)

Uninformed local intervention, one of the major anthropogenic factors, not only has failed to restore lost structural architectural and aesthetic elements of the rock-cut churches but it also has replaced original rock-cut features. Besides this, the absence of governmental attention towards heritage management is costing the country with a profound loss of its incredible built heritages. All the evidences presented in this study are indicators that the study areas cultural heritage is at its critical situation which needs the engagement of concerned stakeholder to preserve the country's past. (Clifford A.2010.)

General Condition and Main Cause of Deterioration of Genetemaryam Rock Hewn Church.

No	Monument	General condition		Main cause of deterioration
1.	Genetemaryam	Poor	Northern facade	Weathering, the nature of the rock (soft igneous rocks.) run off water, flood, rain, salt crystallization
			Sothern facade	Runoff, salt crystallization, wind(weathering),sun, rain(water),bad restoration work,
			Eastern facade	Weathering, wind, Run off, salt crystallization.
			Western facade	Weathering, human activity, rain ,sun, wind

TABLE 1.GENERAL CONDITION AND MAIN CAUSE OF DETERIORATION OF GENETEMARYAM ROCK HEWN CHURCH.

3. CONSERVATION MEASURES TO MITIGATE THE DAMAGE OF THE ROCK HEWN CHURCH OF GENETEMARYAM.

The conservation measure which should be undertaken to solve the problems in this church it should be identify on the surfaces is accompanied by special initials capable of putting general or exact modality of intervention in relation to pre-consolidation, preventive methods for bio deterioration process, cleaning, consolidation and protection and the like to be carry out on the buildings' part. Some of the pathologies or conservation measures which should be taken in this churches are described as follows:-

3.1. PRE-CONSOLIDATION

This is the first intervention before the cleaning and is based on the preventive methods in restoration of the parts of broken up material or reduced to powder which could be damaged during the following cleaning cycle. Real consolidation technics and methods are necessary for this intervention, but in the case of the pre consolidation the treatment is focused on specific parts of the material or the whole structures. For this every parts of the church should be investigated before any conservation work done.

3.2. PREVENTIVE METHODS FOR BIO DETERIORATION PROCESSES ON STONE.

Bio deterioration of exposed stone is primarily dependent on the availability of water and nutrients. Thus, material specific parameters, like porosity and permeability, architectural conditions, which determine exposure and environmental factors at the site will determine the intensity and rate of bio corrosive attacks. Only a comprehensive analysis of all these individual functions, their causes and functional relationships can provide the basis for evaluation and control of bio deterioration processes. (Th Warscheid, J. Braams, 2000.)

Biocides should only be applied, where the environmental damage factors favoring bio deterioration cannot be controlled and chemical interventions are unavoidable

(Warscheid, 2000).The application of water repellants or consolidates to the stone has to be planned and carried out with regard to the prevailing exposure conditions of the monument (Wendler, 1997) and the possibility of future retreatment of the monument Should be considered (Sasse and Snethlage, 1997; Teutonic et al., 1997). When bio deterioration processes are suspected of playing an important role, the development and selection of microbiologically resistant stone treatments is advised. Otherwise the effect of the conservation measures might be of very short-term or even lead to an increase in the microbial contamination and subsequent bio deterioration activity. (Warscheid and Krumbein, 1996).

3.3. CLEANING

Conservation practice has to choose between many different techniques when addressing the cleaning of stone surfaces on historical buildings from dust, soot, and surface crusts. The analysis and characterization of the chemical and structural nature of the “dirt” by mineralogical, chemical and microbiological laboratory analysis is essential (Nord and Ericsson, 1993; Steiger et al., 1993). Water cleaning helps to remove efflorescent and soluble salts and gives temporarily relief from biological infections, but in the long run it leads to a much greater microbial spreading due to increased dampness and humidity (Warscheid et al., 1988a). Mechanical and chemical cleaning occasionally show a restricted efficiency and can cause discolorations and severe damages to the stone work (Ashurst and, 1990; De Witte and Dupas, 1992).The removal of fungal stains with bleaching agents is best carried out by the use of calcium hypochlorite (Barov, 1987; Leznicka et al., 1988).

Cleaning is also an action to remove substances that physically, chemically or aesthetically interfere with the constituent materials of the artistic object. The cleaning process is gradual and selective, but above all controllable at every stage. Cleaning is potentially the most aggressive procedure any historic surface can be exposed and is a difficult task that must be approached with knowledge, understanding, skill and sensitivity. The peoples who are involved in the cleaning work should train well before the work is began. This will minimize the damage

which occur during the work. It is clear then that “clean” is not an absolute state, it is a compromise between the depths to which dirt may be pursued into the hole structure without causing damage; clean therefore means the surface is as clean as can be achieved without damaging the historic surface; which may not, in effect, look very clean. This cleaning work should include both the internal and external surface of the church. A surface cleaning has the purpose of removing the presence of foreign substances which are causing decay. For instance, more algae’s are grown on the courtyard of this church if we are not clean it, gradually it leaks water finally it will cause decay.

On the Other hand, there may be an accumulation of dusts or darken roof of the church due to scent. Cleaning methods are different in connection with the kind of material and of the substance to remove because the chemical process which initiate the decay is mutually related to the material nature. Different chemicals were apply for cleaning work. Like bio seed, Ammonium carbonate in saturated solution and Ammonium bicarbonate in saturated solution;

At the beginning of the work that all external surfaces of the courtyard of this church were covered in extensive areas of organic growth, in particular lichens and moss, to some extent also plants and small tree near to the church. Some lichens produce substances that erode rock surfaces, and where there are thick deposits of moss these retain moisture close to the surface, this will accelerating erosion and decay. Once the scaffolding and temporary roof were in place removal of organic growth began. Achieving this on this historic building made up of rock that in places is soft and disintegrated and difficult to access, was a slow and laborious process, requiring patience and dedication. The tools employed by the site team were toothbrushes, sponges and spray bottles spatula and other materials too. Teams of laborers spent many hours soaking and brushing the stone surfaces to carefully remove organic growth without damaging delicate rock. In some areas, where the rock is denser, or on surfaces considered less fragile, a high-pressure water jet was used. Once completed, all external surfaces were treated with a specialist biocide imported for this purpose. Biocide kills spores and microscopic material

embedded in rock surfaces, and prevents growth returning a few years, when the process may have to be repeated.

Biological patinas may be removed mechanically only after proper treatment with specific biocides. The application should be repeated for two three cycles, with a time period of five-six days between two consecutive applications. The mechanical removal shall be carried out by means of a water cleaning. (Studio Croci (2014.)

Treatment of the higher plants (roots, shrubs, grass, small trees, etc...) by means of specific biocides. After some days, the plants dried by the biocide application could be mechanically removed. If necessary, before the removal phase, a second cycle of biocide treatment should be provided by means of injections. Incoherent surface deposits should be removed mechanically with wooden spatulas and brushes. The surface should then be washed with water.

3.4. GROUTING

3.4.1. GROUTING CRITERIA

Injection grouting is a typical method for reattaching delaminating stone layers and filing voids and small cracks in historic buildings of rock hewn and many other architectures too**.** It has been used for mortar repairs for many years. B-fluid XB, is very essential and the common for grouting the deep cracks and reattaching the delaminating stones. There are also different types of hydraulic lime mortar which used for conserving and restoring rock hewn architectures. Materials like B-fluid xa, for building, pointing and plastering, Nurage for water proofing, opossum and khochopesto as a mixing the ratio of the preserving materials are some of the most important hydraulic lime mortar which used for restoring and conserving ancient rock hewn structures. This material is mostly natural materials which did not harm the rock structures but it is imported from abroad and expensive too. This needs familiarizing them to rescue the huge and irreplaceable resources of our country. The hardness of the grouting materials should not stronger than the mother rock of the church. At least it should be equal or less than the strength of the mother rock.If it exceeds will damage the rock soon. The material should also easily

reversible. During grouting the conservation requirements for grout are: it should be injectable, stable, and able to mechanically bond with the stone and be chemically compatible with the stone. The intervention must also be minimal, if any, shrinkage of the grout. (Warscheid and Krumbein, 1996).

3.4.2. GROUTING METHODOLOGY

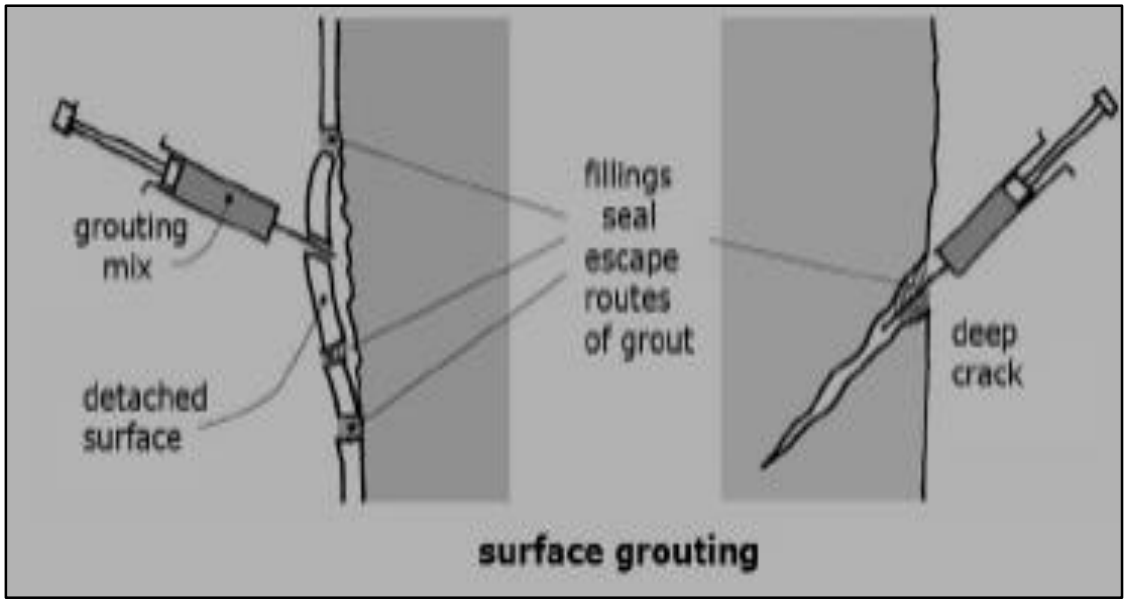


Figure 15: Grouting Methods in Detached Parts of the Rock (Source Giorgio Torraca 2009)

One of the major deterioration problems with basaltic rock churches like Genetemaryam is cracking and delamination along the bedding plane of the rock at the back side of this church. Basaltic rock are formed in layers through deposits of mineral or organic particles. Weakly joined basaltic rock exposed to weather, which have a tendency to separate along the planes. If the stones are placed so that they are faced bedded, the bedding planes are at right angles to the position they had in the ground. Delaminating sandstone markers faces pose serious conservation challenges. It has even been suggested that the service life for some of these stones is many years (Giorgio Torraca2012). Removing deteriorated stone from the delaminating layers and voids is the most difficult process. It must be removed or consolidated in order to ensure proper adhesion with the rest of the stone. Deteriorated stone is glowing from the voids out through port holes as best

possible. An attempt is made to keep the port holes as small but they have to be large enough for debris to be glowing out of them. It can be difficult to remove all the deteriorated stone. Also these holes can be visually disturbing (Giorgio T. (2009).

After cleaning the void is grouted. The grout needs to be as low glueyness as possible in order to flow into the void. Too much water though will result in shrinkage of the grout as it cures. The holes are made into the stone at the void to clean it are used to grouted it from the bottom up with syringes. Many of the grouts are difficult to keep at a low glueyness in the syringe. Where deteriorated stone is left, the bond between the grout and sound stone is not very good. Where the face of the stone had come off either before or during the treatment of a marker, and the deteriorated stone can be almost completely removed, the repairs are quite solid after many years later(Giorgio T. 2009).

Because the success of grouting repairs is dependent on the stone, markers with substantial layers of deterioration may not be treatable. Conservators aim for minimal treatments which limits aggressive treatments. When the faces delaminate, they can be cleaned and most of the deteriorated stone can be removed and the faces are adhered. However, it remains exceedingly difficult to predict which stones can be successfully grouted. The voids vary for each marker in size and location. Each marker collects debris as well as the grains of disaggregating stone in varying amounts and size. Grouting this debris out of small openings is not always effective.

3.5. PRESERVATION OF THE SOUTH FACED OF THE CHURCH.

Once the scaffold was in place, the condition of rock on the south facade could be closely examined for the first time. In some areas pieces of carving had fallen away from the decorative places. In all areas the condition of the rock was alarming. De-lamination, where the surface layer of stone is detached from different parts of the church, had occurred at every places. In some places, large cracks had opened up through the roof and its pillars. The lip of the roof was also found to be in poor

condition, weakened by micro-fissures along its entire length. Preservation of the south facade was a critical part of the preservation process.

Figure16, Damaged part of the south faced of the church (source the author.)

Step one was to clean surfaces and cracks. Syringes and pipes were used to flush out cracks, removing accumulated dirt and organic matter.

Finally the cracks were flushed with formalin to sterilize them. Initially it was hoped that bigger areas of cracked rock could be grouted and pinned back in place using stainless steel dowels. But after close inspection of the rock surface it became apparent that drilling risked shattering the fragile rock further in this part of the church. Instead it is better to use grout material to fill cracks, giving them greater stability and mass. Once grouted, cracks were pointed using Mortars made with locally-sourced aggregate to match the color of the country rock. Where the cracks were too small, a solution of structural epoxy grout was carefully injected into the

cracks. This acts as a kind of ‘glue’, and whilst it is not an ideal solution, where surfaces are so badly damaged it is the only viable option to keep stone in place.

3.6. Addition and Integration

This include a series of interventions with the aim to re-building the damage part on the roof surface and due to the natural ageing of materials, absence of maintenance and mechanical stress. These interventions regard both historical valence of the monument and the restitution of the loss structural efficiency. The reproduction of missing parts is carried out with solutions which allow to discriminate the existing parts from the additions (for example, employment of compatible material but with different color or manufacturing (Studio croci 2014.)

Figure 17, Damage of the rock at its northern faced of the church (source the author)

3.7. PROTECTION

This interventions have the task of preserving the rock from the attack of external natural agents (water infiltrations, superficial deposits, etc.) of anthropic nature. They are carried out at the end of the conservation operation and they serve as proper defiance structures (footbridge) (Giorgio T.2009.) In the case of Genetmaryam church especially its Betelhem was highly damaged because the shelter was not included this part. It needs shelter to protect from rain and the sun.

Damaged Roof of the church Betelhem small plants are grow on it and start to disintegrate due to the rain and it needs a shelter.

Figure18, The roof part of the church Betelhem (source the author.)

Generally the surface protections have a durability and effective for many years, so planning should include these protection cycles. The interventions are therefore to be considered general recommendations on the treatments to be performed, which are essentially based on the experience gained on similar stone materials and decay morphologies.

3.8. CONSOLIDATION

The consolidation actions have the aim to restore a continuity, changed because of the various decay phenomena's, between the external and the internal part of the material in order to restore a structural balance able to resist stresses which caused by different factors on the rock surface. The consolidation intervention will become effective depending on various elements: nature of materials, natural ageing of the structure, various decay pathology in progress, stressed condition. (Studio croci 2014.) There should be also a precise intervention in order to avoid useless generalized operations to the whole surfaces and the possible arising effects. The substance for the conservation has to be compatible with the nature of the material in order to avoid internal shocks to the structure and to able to avoid the attack of atmospheric pollutant.

The consolidation includes sealing of stone materials with various sealants. The interventions proposed for each kind of pathologies depend on the level of the rock damages. The hair cracks voids shall be repaired by means of injections of a consolidating mixture, made up of hydraulic lime, anti-bleeding agent and water reducer. After the injections process, the external face of the hair crack will be treated using water lime putty, mixed with sandstone sand well pressed with a spatula, matching the color and the texture of the stone. Before the repairing works the stones will be cleaned with brushes and water, while dust and deposits will be removed from the crack using compressed air.

Finally, it should be noted that before treating any material for conservation and restoration purposes, the choice of proposed material treatments and methods should be checked in a laboratory and in situ by performing suitable compatibility

and efficacy tests. The interventions described in this document are therefore to be considered as general recommendations on the treatments to be performed, which are essentially based on experience gained on similar stone materials and decay morphologies. (Giorgio T. (2009).

Damaged part of the roof surface of the church before the shelter which needs consolidation work.

Figure 19, damaged part of the roof surface of the church (source the author.)

The analysis of the interventions needed for the monument surfaces preservation shows quite clearly that decay morphologies included in the general family of the features induced by loss of materials (such as cracks, disintegrated etc…) are essentially present on this church surface.

4. PAST CONSERVATION WORK ON THE CHURCH

Since its carving, it has been exposed to multiple natural and manmade factors of deteriorations. As a result the mother rock (the monolithic) has degraded a lot in the course of the time. Conservation were a recent phenomenon in Ethiopia. According to the church father, an initial attempt in this church were made by Sandro Angelini before 60 years ago when he was restoring the rock hewn church of lalibela. It was a partial solution in masonry with white cement applied on the roof and pillars of the church just to its western side. After that a wooden shelter have been constructed several times by the CRCCH (now ARCCH) in collaboration with the local culture and tourism office. Though similar temporary shelter have been constructed recently it could be said that the practice of conservation is still at its infancy.

Figure 20, previous restoration work in Genetemaryam church. (Source the Author)

As to the physical condition of the church, the roof is damaged, due to rainfall, mechanical erosion and degradation. The external facades show a wide set of discontinuities, Specifically, S-E corners are highly damaged, which needs urgent interventions. The other major identified problem is the weathering of South wall as a result of bad restoration with epoxide resins and white cement. The major

reason for the static instability in this church can be identified as the high over load, consequence of the high thickness of the roof (more than 2.5m.).

Past restoration work by Sandro Angelini (the restored part of the church. The work was stopped & undocumented for unknown reason.)

Figure 21: Bad Restoration Work by Sandro Angeleni in Genetemaryam Church (Source the author)

5. ARCHITECTURAL FEATURES OF THE CHURCH.

Genetemaryam is one of the few monolithic rock hewn churches in Ethiopia. The church has 24 outside and 4 internal pillars, 3 doors and 24 windows of different shapes. It is very similar with Bete Medhanialem church by its structure and with Betemaryam by its wall painting. Entry to the church courtyard is through a breach in the south wall of the trench, which has a gate house. (maria,J. and Bob,F).

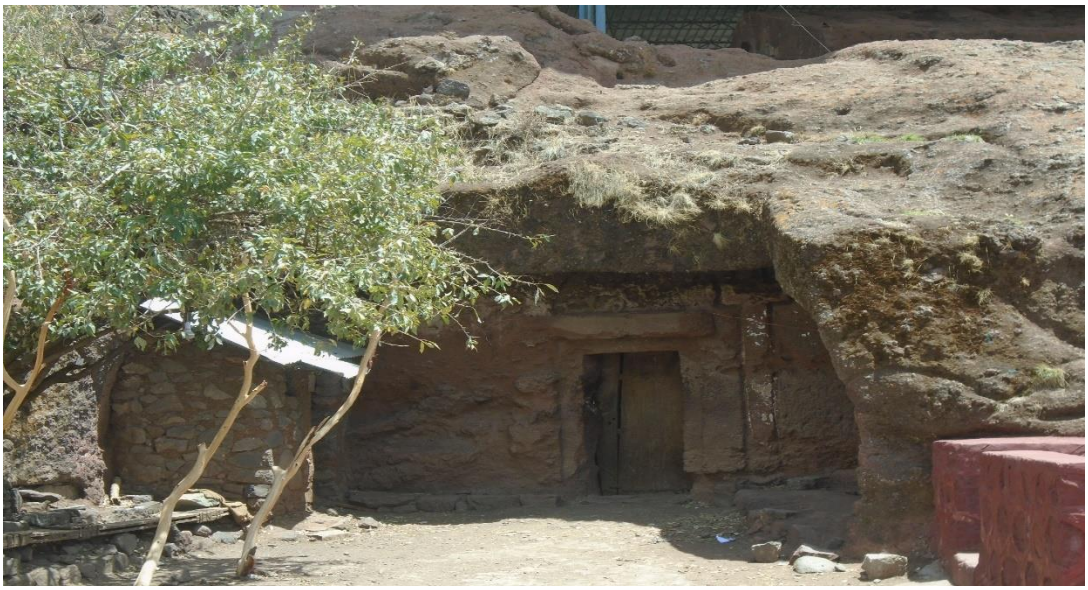


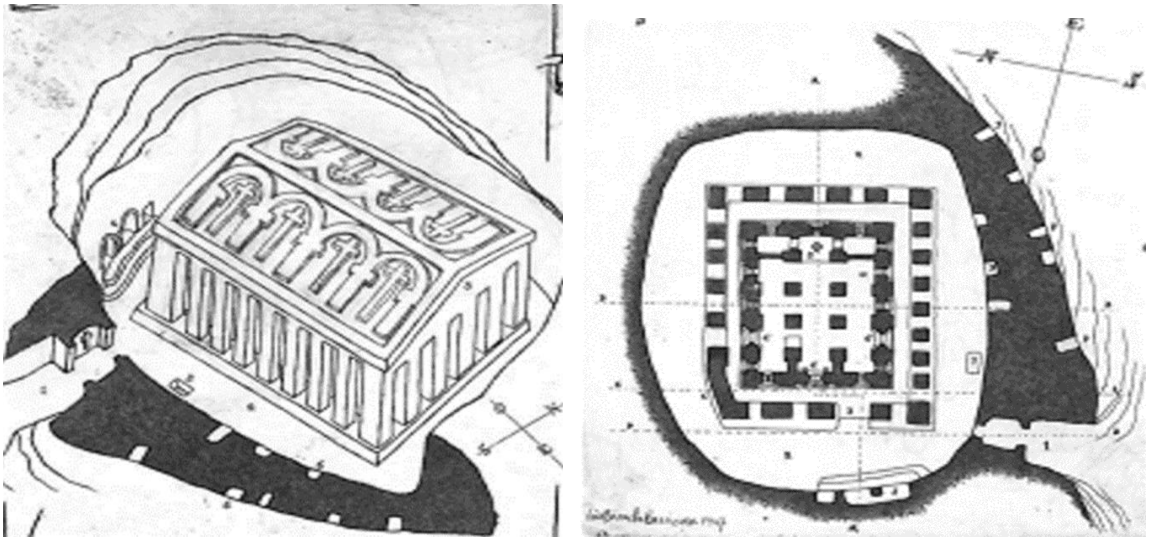
Figure 22, underneath entrance to the church. (Source the author.)

In the trench west wall, two open rooms have been excavated, the larger having a central rock hewn column. If you visit the church fairly early in the morning, you will be able to see and hear the priests beating their drums and shaking their sistra in these rooms.

Figure 23, Qinemahlet outside the church, (Source the author.)

The exterior dimensions of the church are: 20 *meters* long by 16*metres* wide and 11 meters high. It has a slightly truncated saddle back roof and colonnade of rectangular, rock- hewn pillars, which run around all four walls, evocative of Greek temple. Each slope of the roof has been carved with four arches resting on corbelled capitals at the top of pillars; within each arch there are carved crosses. (Maria j. and BobF.2015).

Figure24, Isometric 3d render (source Betsegaw Ayenew.)



Figure, 25. Plane and perspective of the church. (Source Baravera.)

The whole church stands on substantial plinth which is breached where the three door give access to the interior. However, the gap in the west is displaced relative to the lion of the main entrance. (Maria j. and BobF.2015).

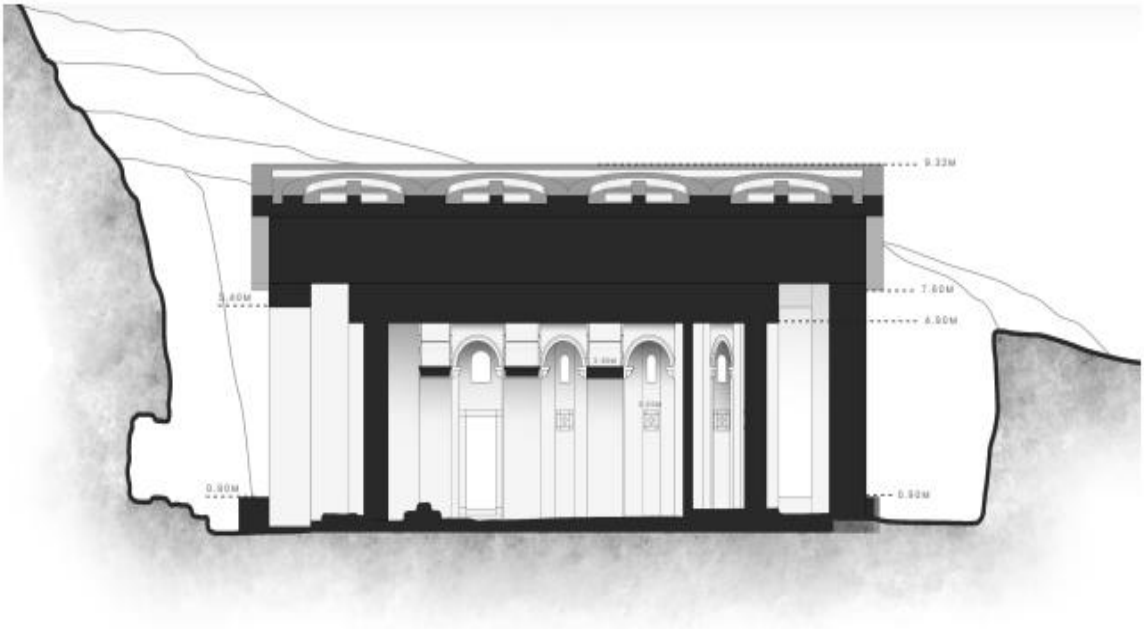
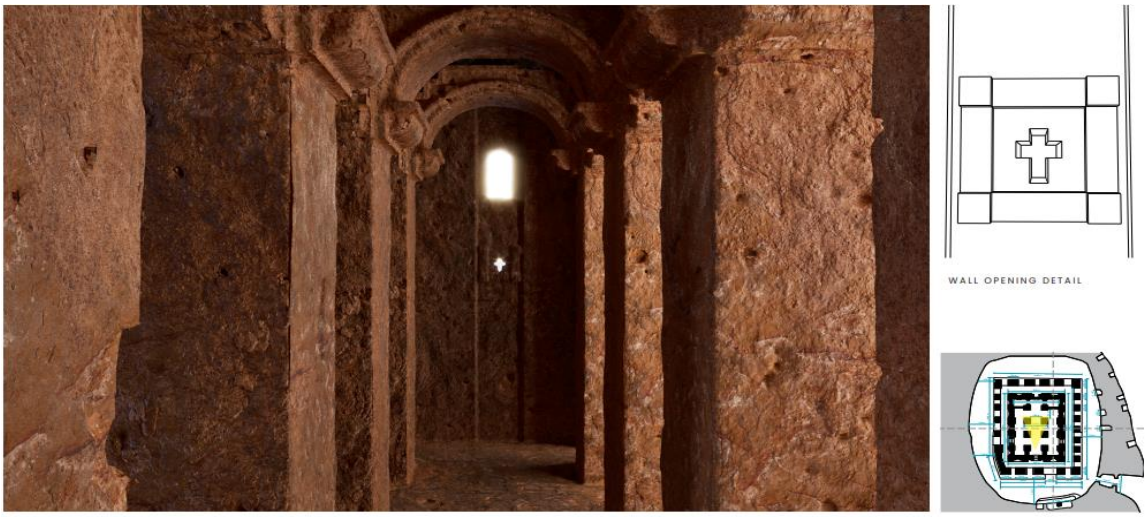


Figure 26, Section B-B sectional drawing of the church (source Betsegaw Ayenew).

Figure.27. Windows, doors and pillars of the church, (Source the author.)

The interior is of the basilica type with a nave and two aisles separated by two row of four rectangular columns.it is four bays deep and has a sanctuary at its eastern end.



Fig, 28.Perspective interior scale, (source Betsegaw Ayenew)

On either side of the entrance there is a full-height wall joining the exterior wall to the first pair of columns, thus creating an entrance. The columns have no base but do have pseudo-capitals of carved corbels and imposts of the type that are prolific in Lalibela's monolithic churches. The columns are connected one other by arches.

CHAPTER THREE

3.1. CONSERVATION STATUS AND CURRENT CONDITION OF THE CHURCH TREASURES IN GENETEMARYAM.

Genetemaryam possesses ancient, historic, and religious treasures which have diversified values for different stakeholders. However, these priceless treasures could not be much accessible for many reasons. The condition of those treasures are at critical due to various hindering factors. The wall painting become dark and covered by dusts. On the other hand, the parchment books script are discolored and wiped way, the cross are broken and the vestment are affected by insects and moistures.

Although the condition of the church treasures are critical, there are many church treasures found in the church. This includes both movable and immovable cultural heritages of the area. According to proclamation No.209/2000 (of ARCCH), Movable cultural heritage comprises: parchment, manuscripts, stone paintings and implements. Sculptures and Statues made of gold, silver, bronze, iron, copper or of any other mineral or wood, stone, inscriptions of skin, any other material, and also Paleontological remains. On the other hand, immovable cultural heritages are heritage that are fixed to the earth with a foundation that cannot be moved from place to place unless and otherwise dismantling them. Some of the immovable cultural heritages, buildings, monuments, Churches, memorial and burial places, historical or pre-historical archaeological sites are the most important one (Proclamation 209/2000 of ARCCH);There is strong connection between intangible heritages discussed above and tangible heritages. Tangible heritages in this churches include Arks, Icon paintings, crosses, Tsinatsil (sistrum), Mekuamia, Kebero (Drum), gifts from different people of differing ranks collections with in the eqabet and many others. These heritages are brought into churches either for ritual services or simply kept as heritages of the churches. Some of the tangible heritage of the study area are described below.

Table 2 *Tangible Cultural Heritages in Genetemaryam*

No.	Name of the church.	Heritage Treasure with in the church				General condition of the church Treasures.
		Painting (group 3)	Manuscript (group 4)	Different heritage (group 5)	Total no. of heritage.	
1.	Genetemaryam rock hewn church	15	67	54	136	Most of which are in a critical condition& needs a museum.

Nb. ***Group 3. For Icons and all works of painting found in the church.***

Group 4. Only manuscripts of the church.

Group 5. For cross, vestment and other different types of church treasures.

3.2. THE CHURCH TREASURES IN THE EQABET COLLECTIONS OF GENETEMARYAM ROCK HEWN CHURCH.

In this churches there are various collections which have been made from organic and inorganic materials, and almost all are ecclesiastical. The lion shares of the collections are parchment books and crosses. The church was one of the hubs of church education since its establishment, According to the church fathers, the monks who had come to the Monastery to continue their education wrote different religious, philosophical and astronomical books. Nowadays there are hundreds of parchment books with in the Eqabet* collection of Genetemaryam church. Some of these are not found elsewhere both in the country and abroad. Those parchment manuscripts are collected from 13th to 18th century in different area. In fact most of which were written and copied with in the monastery by different church scholars at that time.

Figure 29: Parchment Painting At the Church Of Genetemaryam. (Source the author)

The entire book collections in the eqabet are parchment made of the skin of animals particularly from goat and horse skin and written by hand. To write on the manuscripts they used red and black ink, which was prepared from different plant leaves, flowers, soils and cereals. To accomplish a single book it could has taken half a year or more. The inner sheets of many of those books are adorned with various paintings of saints, prophets, martyrs, angels, Jesus Christ and Holy Virgin Mary. As illustrated in Figure: 3 parchment book, there is very astonishing painting of Abune Gebremenfes Kidus is painted in the parchment at different pages which is found in the church.

The other stunning heritage in the eqabet collections is the crown. These Crowns are other collections in eqabet. They are made from silver and bronze. In the eqabet there are many crowns gifted by different emperors of Ethiopia. Which are decorated with different design and have different sizes. Also there is a cross over the upper tip of each crown. This signified that the then emperors were Christians

Figure 30: The Crown of King Ykunoamlak Made Of Bronze and Leather (Left), Processional Cross in the Church Of Geneemaryam. (Right)(Source the author)

In the eqa bet there are various crosses in different show cases. They are made from different materials, such as gold, silver, brass and wood. They are hand and processional crosses. Regarding their style there are Axumite, Lalibela and Gondarian. Different words and pictures are inscribed on some of the crosses which increase their beauty and show the ability of the then artisans. They are handover to the church by different kings, dignitaries, nobles, bishop and priests Crosses are used in numerous ceremonies, performances, and festivals. It is also different in size, design, material which made from the purposes they are used. Based on their size and purposes there are three types of crosses. Processional, Hand and Neck crosses. Processional crosses are large crosses. Such crosses used for the blessing of the congregation and water for baptism. Hand cross it is smaller than the processional cross held by the priest to bless the believers and for the mass program and the neck cross for tying on their neck to indicate they are a true Christians.

During annual ceremonies and special occasions, priests take processional crosses out of churches and rise above the head of the crowd. In most cases the base of processional crosses have hollow. In churches like Genete Mariam priests bring out processional crosses to show for tourists.

Different icons are hanged on the wall of the eqa bet; they are diptych and triptych. The image of Saint Mary with her beloved son is depicted in one of the icons and other saints are depicted on the other folds of the wooden plate. They have a potential to grasp the attention of any visitors. Although they were made 13th century ago, it seem recent and new. The image of Saint Mary together with the Angels, Saint George, the apostle and saint Abune Teklehaymanot are depicted on the wooden plate. However, the frames of each panel are carved from a single indigenous and well refined wood. These wooden panels were jointed together by using leather string instead of metal hinge by drilling at the junction of the two panels.

Figure 31: Triptych Icon in Genete Maryam Church (source the author)

As earlier discussed, this churches are very old and historic. Since then, in this churches there is a bell which is made from bronze and silver. In the middle of the tower the historic bell is hanged. This bell has been used as an alarm for monks to wake up for church services and during the mass program. It is circle in shape and produced different sounds when it is struck. This type of bell is common in most ancient monastery of the study area.

Tabot in any church is referred to the saint or Martyr to whom the church is dedicated. But there are circumstances two or more Arks are kept in one church. For instance, the church of Genetemaryam has the Ark of Abune G/menfeskdus and St. Marry in separate sections. The ark are kept in sanctuaries of the churches. In most cases sanctuaries are situated eastern direction of churches. Being the place where the Ark is kept, it is accessed only by priest.

Tsinastil (cestrum) and kebro (drum) this are another church treasure found in the eqabet collection of Genetemaryam church. Cestrum is small hand held instrument. When shaken the small rings attached to thin metal move to produce sound.

Figure 32, priest singing by using Sinasl (cestrum) in Genetemaryam church. (Source the author.)

Tsinasil and Kebero are the two musical instruments widely used in churches. These instruments are used during liturgy and other rituals and ceremonies. Kebero and Tsinatsil are musical instruments employed in spiritual songs. Some of them appear in slightly differing variants. It is played by tapping the two ends of differing size with hands.

Figure 33 smagondere Kebero in the curch of genetemaryam church (source the Author.)

Ethiopian Orthodox churches are among historical places of the country where one can find centuries old Manuscripts, which held an important position in the studies of church and the country's history. Some of the manuscripts were registered as a world documentary heritages like the Holy Bible, Mezmure Dawit etc. where as in Genetemaryam church the manuscript and cross take the lion share of the eqabet collection. The eqabet is reach in centuries old crosses, manuscripts, paintings. Some of the manuscripts are found only in Ethiopia. Manuscripts used for church services like liturgy and for daily prayer. I had the chance to see many manuscripts during my work at Genete Maryam and other many churches too.

However, the condition of those church treasures were in a critical conditions. To avoid the damage of our heritages different Heritage management activities should be done. This include documentation, conservation, promotion and researches aspects of heritage management are pillars in safeguarding and making heritages known to the general public and academic community.

On the other hand, one of heritage management activities was heritage inventory or documentation of cultural heritages.it is indispensable for purposes of identification, protection, interpretation, and physical conservation of heritages. Therefore, annual heritage inventory is compulsory to know the physical condition of those treasures and to assure its existence. But it was not done regularly because lasta woreda is very vast and more than 200 churches were found in the area .Genetemaryam was one of the church found in Lasta woreda and this needs large amount of budget and qualified professional in the field to work regularly. Before the inventory process began different committee were recruited among the stakeholders. The stakeholders can be from the church officials, the police officers, from the town administration, from the community representatives, the guide association. This stakeholders are working together with heritage inventory professionals. During inventory the professional clearly document and this inventory processes includes: registering the name of the treasures, owner of the treasures, date of registration, give a code number for the treasures or recording its previous code numbers, photographing it, the importance of that treasures, documenting the unique features of that treasures, the physical condition of the treasures weather it is in a good or a bad condition, threatening factors for the treasures if available, previous history of the treasures, its age, and the like ,the same process are taken place for registering the building itself. After registration all the stakeholders are sign and formally report to the owners. Finally the heritage inventory professional prepare it in a data base form and send it to zonal, regional and federal heritage authority office's. I suggest, this inventory document should be also modified it is not included the whole features of that treasures.

Documenting movable and non-movable heritages gives data regarding the state of the churches. This in turn paves ground for conservation activities on the churches. Recording heritages in the churches is an important way of fighting illicit trafficking of heritages. Inventories constitute primary resource databases for scientific study and research. The compilation of inventories should therefore be regarded as a continuous, dynamic process. It follows that inventories should comprise information at various levels of significance and reliability, since even superficial knowledge can form the starting point for protection measures (ICOMOS Charter for the Protection and Management of the Archaeological Heritage1990; article 4).Keeping record of the churches (as a building) and movable and non-movable heritages helps researchers, conservators and developers to decide where to start their works. There are attempts made to document rock churches and movable heritages in the churches by Culture and Tourism office at local level.

3.3. Conservation Challenges of the church treasures in Genetemaryam church.

3.3.1. Poor Handling System of Treasures.

The church treasure has been facing great damage due to poor handling method and lack of museum. As stated earlier some of the parchment books were covered with wooden panel, fine leather and cloth. However, due to long age many of their cover are damaged, even some parts of the parchments' script are discolored or wiped away. Due to moisture and placing external material within the parchment cause discolor of paintings within the book.

The worst problem is compiling different parts of the different books in one collection. Some of the parchments, and vestments are affected by moisture and insects. Lack of appropriate handling also causes devastation of the manuscript, crosses, vestment and other treasures that are found in the church.

Lack of conservation of these church treasures due to lack of trained manpower and finance is also serious problem faced by the church. There should be a workshop center where those church treasures are maintained and reproduce for its sustainability. There is a wide gap in this regard. However, compared to the earlier time only few church scholars are still practicing it but, it seems that there is no anyone who is eager to inherit this skill and knowledge because it needs great talent and devotion of their life to be more proficient in this field. The current easily means of reproduction of printed machines also other factors not to focus much on the parchment books. So much concern are not taken in this regard.

Figure 34: Damage of Church Treasures in Genetemaryam Church Due To Lack of Proper Handling (source the author)

3.3.2. LUCK OF DOCUMENTATION

Lack of documentation is another challenge in the study area. There are many historical assets and resources which can express the area in a meaningful way. But they are found as oral tradition rather than being documented, and thus kept to transfer to future generations. Even the resources and assets which are precious heritage are found without proper registration and documentation on their age, use, history, materials from which they were made, its physical condition and other related issues. This lack of proper documentation also aggravate the loss of this precious and irreplaceable heritages.

3.3.3. Lack of Security Personnel

In Genetemaryam church, there is challenge related to security personnel. The church assigns two individuals from the community to keep the property of the church. They pay them once a year in the form of grain after they collected from the peoples. However, the sharing of responsibility among themselves is taken as a challenge sometimes this leads to conflict and revival among the priests and deacons. Some of the priest are conspired to be the chief priest of the church which in the other hand leads to stolen of the treasures when one another rival each other's. The absence of a permanent security guard is a great challenge to the church of Genetemaryam and many other churches too. In some case, the guards are very old this physical weakness allow some church treasure dealers to steal the property easily.

3.3.3. Lack of Awareness

Though the churches have immense heritage tourism resource, it is not yet exploited properly due to lack of awareness about them. The local community and the clergy have not distinguished which elements is tourism attraction and which is not. Even they are not open for visitors, rather the church uses them for other purposes. Above all, both the general public and foreign visitors are not aware of the existence of such invaluable heritage resources in the church. On the other way, most of the treasures they were simply kept it in a dark room under a cold air condition, they don't use it regularly this way of keeping the heritage exposed for damage, because those treasures needs regular treatment. It may beaten by worms or other insects or the cover of the parchment or the cross may broke. The written on the parchment may fade. In this regard, awareness creation for the priest play important role in preventing those treasure from harm.

3.3.4. Illicit Traffic

Trading cultural materials is ever increasing business. The business sometimes accommodates theft and illicit transfer of movable heritages into its system. This attempt was made particularly in Genetemaryam and other the nearby churches

too, even though the punishment was not sufficient enough, to restitute the heritage together with the town security force we were working and who steal was put in jail. According to the lasta administration Police Office, heritage theft and robbery were lessened recently before 1997. Credit for this goes to the local community for being cooperative and helpful in safeguarding the heritage items such as important artefacts.

Despite the presence of laws by international organization like INTERPOL and countries of the world directed towards protection of cultural heritages, the act of exporting cultural heritages out of countries border is still a crime threatened cultural heritage (UNESCO 2006).Illicit transfer of cultural heritages is one of and by far the most threating problems. Considerable numbers of Ethiopian heritages are found outside the country. Based on the data from authority for research and conservation of cultural heritage/ARCCH/ (1990) the country has more than 834 illegally exported heritages in many European countries. They put those treasure in there museums and galleries. In the context of heritage management, absence of documentation of heritages is the major factor that opens favorable condition for theft and illicit trafficking. Systematic documentations pave good way for controlling and supporting efforts to restitute stolen heritages.

3.3.5. LUCK OF PROMOTION OF THE HERITAGES

Despite the fact that the churches has immense movable and immovable treasures It could not be accessed by the tourist due to several reasons, lack of promotion is the prominent one. The churches does not have its own website that can help to promote their resources; however, they did not promote the tourism resources either through printing or electronics media due to lack of finance and trained man power. There is only a single billboard on the way to the monastery or in the nearby town of lalibela to indicate the direction where the church are located. Due to this and other related hindrances, all the innumerable and priceless heritage of the church became inaccessible for domestic and international tourists. So the country in general and the community in particular are not much benefited from the

heritage. Promotion plays a pivotal role in supporting conservation efforts, bring about public understanding and increase tourist flow to the sites. The notion of promotion of heritages is not exclusively confined to the task of introducing the heritages to Ethiopian and foreign tourists. It includes preparing written reports on the state of heritages and disseminates information which enables the community living around the churches and the general public understand the heritages better. On the other hand like any other heritage management activities promotion of cultural heritage should be combined effort of the public, scholars, governmental and non-governmental organizations and the community.

It is collective efforts of different organization and the public bring about better promotion of the heritages. Introduction of electronic media into the promotion sector is a great leap in the efforts to make heritages known to the general public which in turn create platform for the overall heritage management works. It provided good way for people to share their experiences within short time and in very easy way. Internet with its multi facets of communication facilitated easy way of uploading photos, videos and shares their experiences in written form. Promotion on webs and through electronic Medias addressed many rock churches.

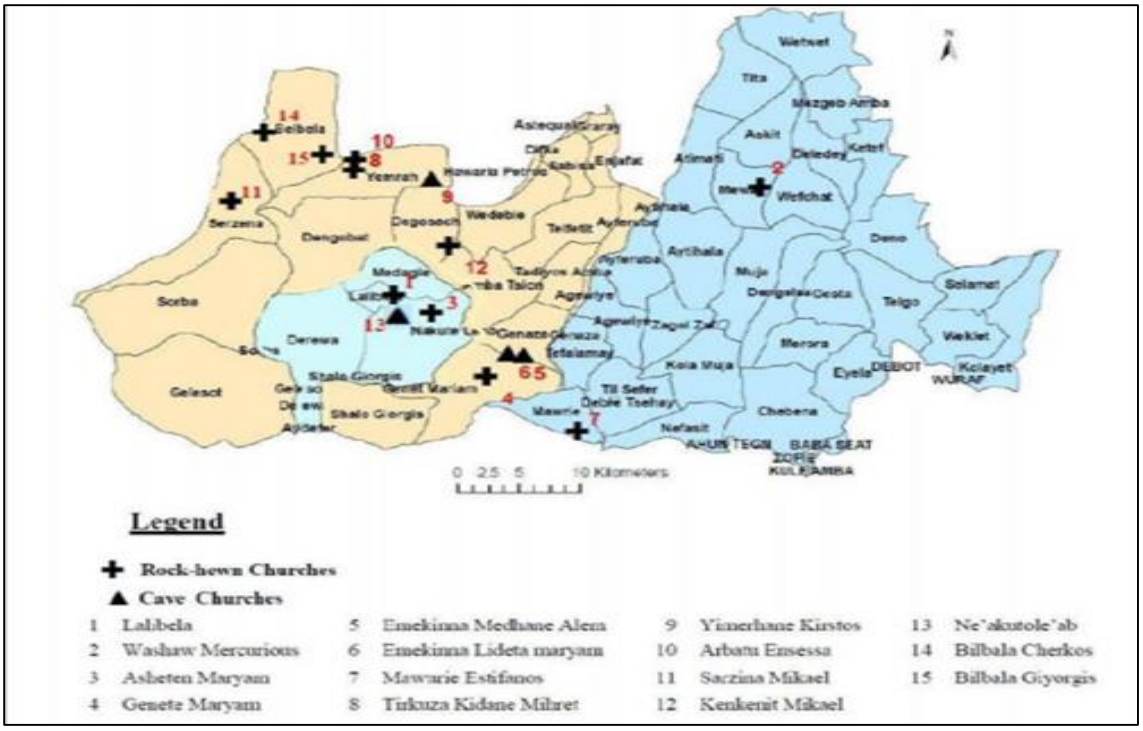


Figure 35: The Distribution of Rock Hewn and Built -up Cave Churches of the area.

Source: From Lasta Woreda communication Office.

In few years ago, EBS and other Medias too has done great deal of task in introducing Genetemaryam and other many historical places. This efforts helped introducing the country's heritages. An organized trips to the churches of Lalibela and together with the surrounding churches of Genetemaryam and other many historical places. This efforts helped to introduce heritages hidden in mountains and inaccessible areas of the country. Few other rock churches of also favored from the documentaries of EBS. The contribution of short documentaries by ETV and Amara Television Program and private and government radios is undeniable. But it was not as such as it was expected as compared to the neighboring countries of Kenya and Egypt.it will require a great effort in the near future. Little efforts are made to produce works based on researches and address churches other than known elsewhere on the internet and other Medias. Most programs on rock churches are focused on the world heritage site. On the other hand except on few webpages of tour operators and government institution it is difficult to find rock churches on webpages Prepared to promote the churches of Genetemaryam.

Printed Medias are other forms of promotion and by far the common methods as far as promotion of heritages of the country in general and the Genetemaryam area in particular is concerned. Increasing of publications on rock churches without doubt helped promotion efforts. For instance, publications on rock churches of Genetemaryam brought about success in attracting many tourists in different parts of the world. When it comes to other rock churches promotion tasks are very slow like the church of Genetemaryam. Promotion using printed Medias like Magazine, newspaper, broachers and others is rare. In fact this church at least mentioned or in some cases described well, but the records are not available in the way everyone access them. It simply kept on the church parchment and on the hands of the priest.

In any case attention should be given to the promotion aspect of heritage management and it must be conducted in the way it integrates tangible and intangible heritages. The overall promotion efforts so far are not enough compared to the potentials of the churches. Planned and organized programs through different Medias are the key to unleash potentials of the churches. Promotion is also another way of supporting conservation and research activities and to generate income for the peoples of the area.

CHAPTER FOUR

4. DISCUSSION ON FINDINGS OF THE RESEARCH, CONCLUSIONS AND RECOMMENDATIONS.

4.1. SUMMERY ON DECAY FACTORS

A characteristic of this monuments is that it hewn out of rock hewn structures which rests upon a bedrock of basalt. The peculiarity of this rock hewn Church is a true monolithic or, in other words, separate from the mother rock on four sides and top. Others still semi Monolithic or built up cave churches belong to other types of hewn out architecture.

Generally speaking, the structural uniqueness of this rock hewn churches, compared with the built up in the fact that rock churches works in close relationship with the mother rock. This decisive factor have both positive and negative impact on the nature of the rock. It is very important to support and distribute loads, even in the presence of factors such as shocks; it is however subject to other kinds of risks since the architecture is affected by dampness, infiltrations and movements. (Ipogea-2008.)

This rock hewn architecture is monolithic or, in other words, free from the mother rock. A true monolith, being the result of hewing a single block, has pillars, arches and vaults all connected between them and solidly anchored both to the bedrock and to the ceiling. Structures, therefore, are not subjected to the effects of loads and are less sensitive to possible shocks. Nevertheless, very large monolithic structures, as it is the case of Genetemaryam, suffer greatly from seismic shocks, due to the oscillation of the upper parts, where the enormous load of the roof bears upon an architecture which is free on all four sides from the mother rock.

Heavy loads of roof of the church,it is difficult to sustain its load.

Figure36, Heavy roof of the church. (Source the author)

Pathologies of this type of the monument depend on deteriorating factors generated by erosive conditions, which are both geological, biological and artificial, also to deteriorating factors of a structural nature. Decay factors in the churches of Genetemaryam can be explained as follows:-

- This churches present a range of structural and deterioration problems for each single situation; there is a high discontinuity of the rock in which the churches are hewn.
- Generally such discontinuities (crack) have been used during or after the hewing of the monuments.

Large cracks on the roof parts of the church due to natural factors.

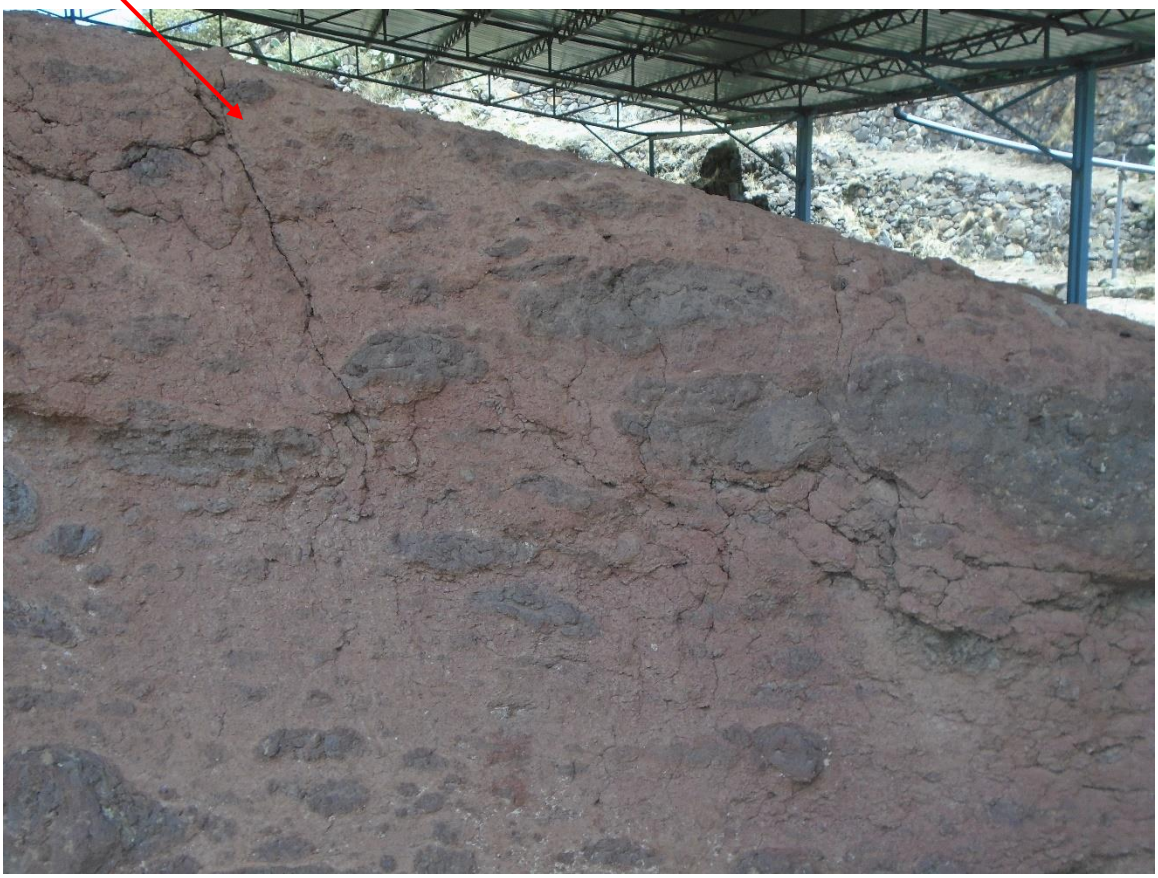


Figure 37.Large cracks on the roof parts of the church. (Source the Author)

- In all cases the water factor carries a high responsibility in the alteration of materials. Water, therefore, shares a high degree of responsibility in all decay phenomena, with varying degrees of seriousness.
- Roofs are always very heavy and constitute a weakening factor for this monuments.

4.2. SUMMERY ON THE EROSION FACTORS

Deteriorating factors of erosive nature vary according to place, exposure and nature of the rock. Their effects on a monument depend on the typology of the monument itself. This monolithic rock hewn churches are highly suffer from erosion phenomena which derive from the exposure of their walls to atmospheric agents. In this case, the most relevant challenges agents are the wind, rain, variations in

Eroded surface of the roof due to weathering effects

Figure 38: Eroded surface of the roof due to weathering effects. (Source the author)

Sun and temperature. Winds carry sand which causes corrosion or abrasion of surfaces leading to decay and loss of material. Alternate exposure to sunshine causes expansion by heat which highly increase such phenomena. Above all, the most serious erosive agent is water, this may derive from rain or from the soil. Rainwater alters the physical composition of the rock, it dissolves it, it penetrates the cracks, it carries biological pollutants and agents causing disintegration accelerating decay. Underground water causes decay effects typical of this monolithic and its wall structures. This manifests itself a strong erosion which affects the base of the monument. Water migration inside the monument and its evaporation on its surface causes the disintegration of bonding substances and thus dissolving the rock. Decay remains confined to the lower part of the

monument both because there is a physical limit to the possibility for the water to rise, and because lower parts are generally in the shade and more prone to damp condition.

4.3. SUMMERY ON STRUCTURAL FACTORS

This church are the result of an incredible, patient digging work, carried out by removing material with a strong influence from the local art (Axum).in this case The predominant type is the rock hewn one, with all four sides and the space above the roof free from the rock. We can thus summarize the structural vulnerability of the monumental site of this church as follows:-

1. This rock hewn structure has been, for centuries, constantly exposed to weathering, particularly rain, lacking any form of protection apart from the same rock.
2. Rainfall has a devastating effect on the conservation of the churches; it flow through roofs and walls, causing volume variations and triggering a series of movements resulting in fractured surfaces.

Figure 39, its previous restoration work start to breaking (Source the Author.)

3. The material appears deteriorated in many places as a consequence of the physical and chemical modification due to weathering; its mechanical properties are highly variable even within the same building, nonetheless being a good building material, its performance in resistance is very rarely compromised.
4. The dimensions of the buildings are large; the roof in particular is exceptionally thick (probably the intention was to bring more strength) requiring an equivalent thickness on the vertical members; this may turn out to be critical, especially in terms of balance, when the fractured system becomes moving.
5. There is a lack of information concerning the strictly structural level that describes, for example, the evolution of fracture patterns, their real dimensions and disposition; this kind of knowledge is essential to make a diagnosis possible.

5. CONCLUSION AND RECOMMENDATION

5.1. CONCLUSION

Generally speaking, there is a complexity of phenomena acting in the rock hewn churches of Genetemaryam. Sometime only one mechanism is prevailing, some other times there is the combination of multiple factors leading to the damage of the structure. The identified effect of chemical or physical degradation processes include:- Mechanical erosion produced by rain drops; Alteration of uncovered external part of tuff formation exposed to climatic factors, also benefited by vegetation and plant roots action; this severe problem where worse particularly if there is a limited thickness of roof; Degradation (alveolization) of some particular sensitive tuff strata and/or critically exposed particularly at the back of the building; Erosion of tuff formation in consequences of water percolation; Presence of discontinuities with direction and dip capable to generate a sliding and Biological colonization.

The measure to tackle those damage which threaten our heritages are cleaning, grouting, addition and integration, protection and consolidation are some of the Solution to solve the damage which encounter our priceless and irreplaceable heritages. The solutions proposed are based on fundamental restoration criteria of possible reversibility, Minimum intervention, Use of materials and techniques that are compatible with reversibility and with the ancient building and Recognition of new integration.

The areas is house of indispensable and priceless treasures, particularly substantial number of manuscripts. The church with its invaluable religious and secular antiquities has the most important heritage potential to draw both international and national tourists in the area.

The protection of cultural heritage is a key issue around the world today, therefore, laws and legislations were issued in order to emphasize the importance of objects of different cultural values and to call for the preservation and restoration of these resources.

The tangible and intangible dimensions of the heritages contribute to the significance of the Genetemaryam as a sacred or religious site. Due to the presence of different hindering factors, the heritages of this rock hewn church are not properly utilized and the flow of tourists is not satisfactory.

The research findings reveal major challenges that have hindered the churches to develop heritage to its full potential. Lack of promotion works; poor handling system of the treasures. Also, lack of standard museum is another contributing factor.

5.2. RECOMMENDATION

In order to properly utilize the heritage potential of Genetemaryam Properly, the following recommendations are forwarded:-

There should be a work shop center for the training, maintenance and reproduction of those irreplaceable church treasures. Also laboratory, to test the effectiveness of those materials used for conservations.

The architects and curators of monuments should collaborate with specialists in the physical, chemical, and natural sciences with a view to determining the methods to be adopted in specific cases;

The church needs immediate intervention with multi-disciplinary approach

As there might not be no sufficient budget allocations the existing old shelter should be replaced based on proper study in light of weight shelter approach.

In regarding to urbanization and other human activities near the site, all the concerned bodies including heritage professionals, the church administration and culture and tourism office and other concerned body should work together in harmony to solve the overall those problems.

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APPENDIXES 1.

Interview Questions

I. Interview details:

A. Name_____

B. Social position_____

C. Place of interview_____

D. Date of interview_____

II. Questions

1. What are the major heritage potentials of Genetemaryam areas?

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3. What were the Public Awareness and Involvement of Local Community for the Preservation and protection of heritage in Getemaryam?

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4. What types of major Church treasures are found in the Eqabete Collection of Genetemaryam Church ?----------

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5. Are those heritage are properly documented, promoted and preserved? If yes or no please write your suggestions?

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6. What are the major challenge of the Church Treasures in Genetemaryam Church? If yes or no please write your suggestions?

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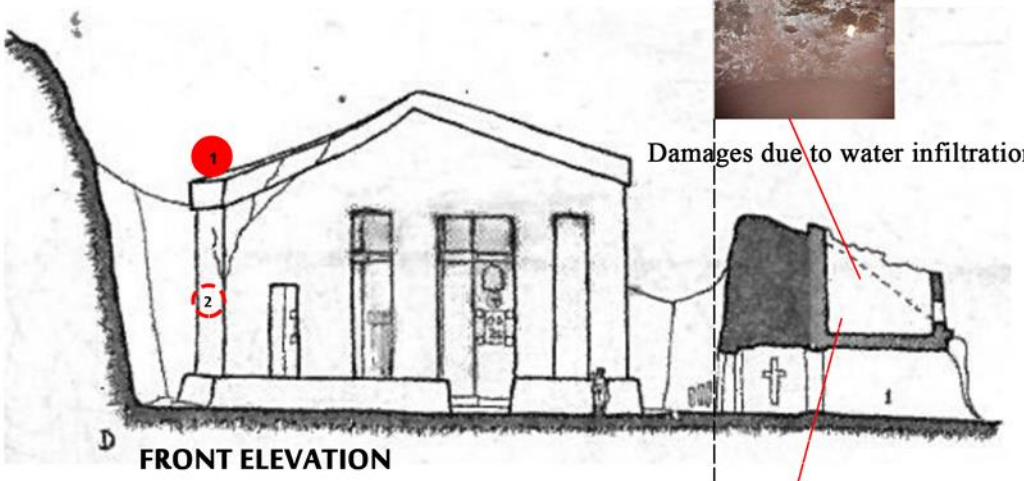
7. What are the major contributing factor for the deterioration of Genetemaryam rock hewn churches? And measures to mitigate the damage of this rock hewn heritage?

DAMAGES ON THE FRONT FACADE

Damages due to water infiltration



FRONT ELEVATION

1

Damages due to water infiltration

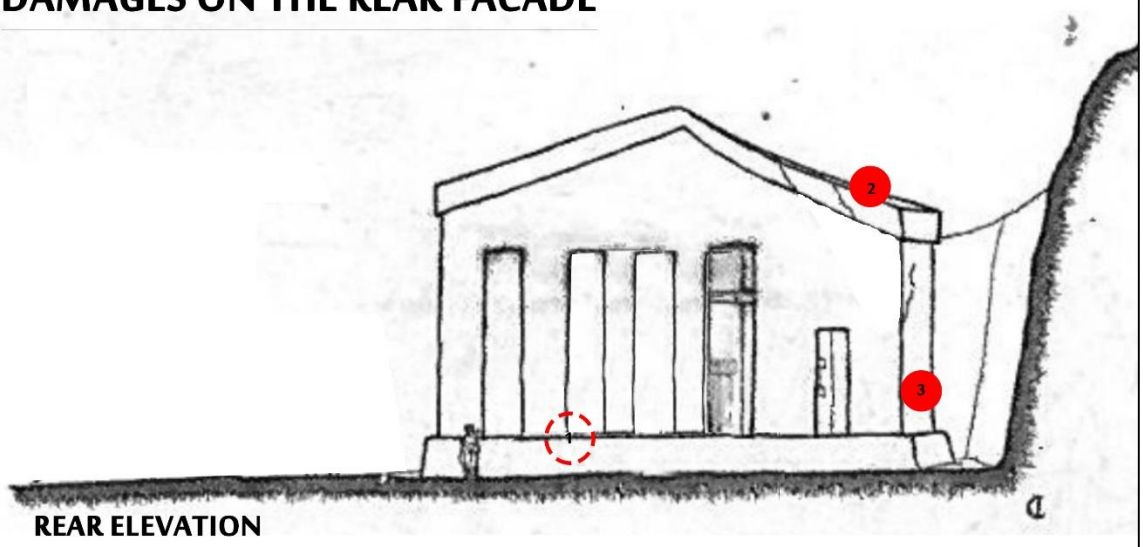
Damage of the rock due to bad restoration work.

2

Damages due to Efflorescence

Efflorescence is a deposit of salts, usually white, formed on a surface, the substance having emerged in solution from within. This is caused by the evaporation of water from the surface of the rock leaving the salt behind. This salt in return deters the rock

DAMAGES ON THE REAR FACADE



REAR ELEVATION

1 **Weathered rock due Erosion**

eroded parts of the rock due to large amount of rainwater and cycles of wetting and drying.

2 **Weathered rock due to sun and rain**

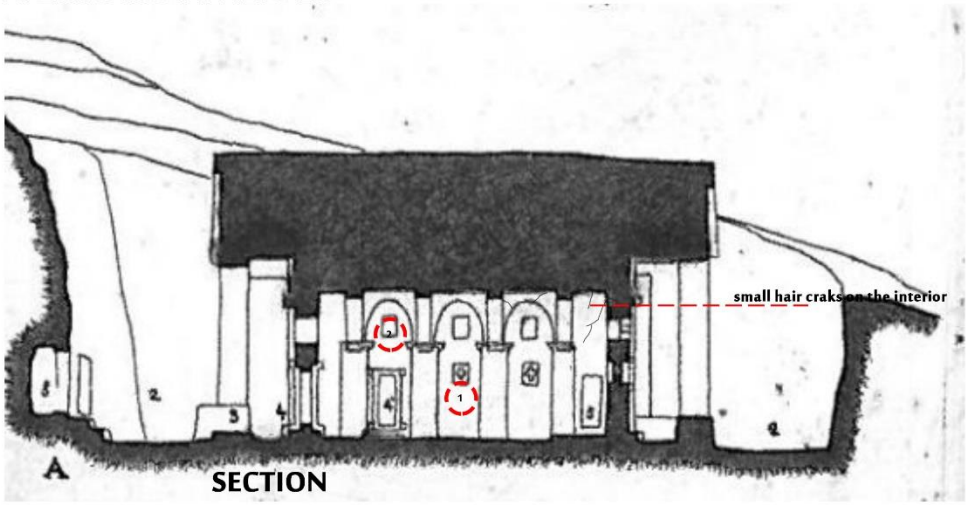
The weathered part at its roof eastern edge due to fluctuation of sun and rain

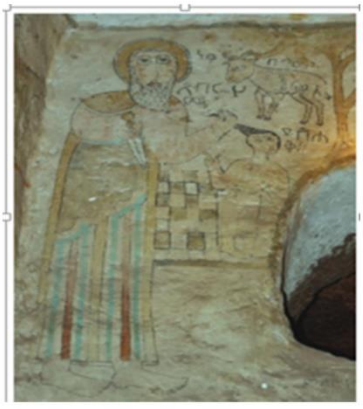
This is a phenomena of breaking down of rock elements through time due to natural factors. Ones the part of a rock crumbles and the crumbled element eroded by wind and rainfall

3 **Crumbling of the rock**

A large section of stone that has become detached from the rock surface. In this case there was a gap of 20cm between the top of the lesion and the original stone bed. Typically gaps fill with soil which encourages plant growth. The wider the gap the more moisture penetrates into the opening, exacerbating the chemical processes that lead to contour scaling

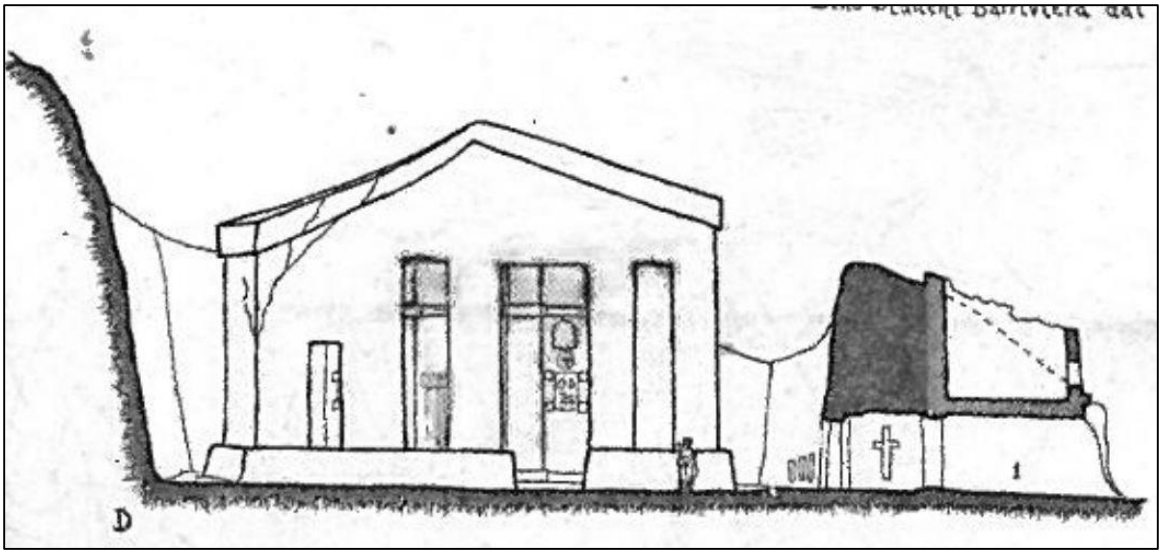
INTERIOR DAMAGES





paintings inside the churches has occurred in the previous years due to natural and many other human factors. The paintings properties and decay factors should be thoroughly studied in order to define restoration solutions.

The paintings are now deteriorating and need restoration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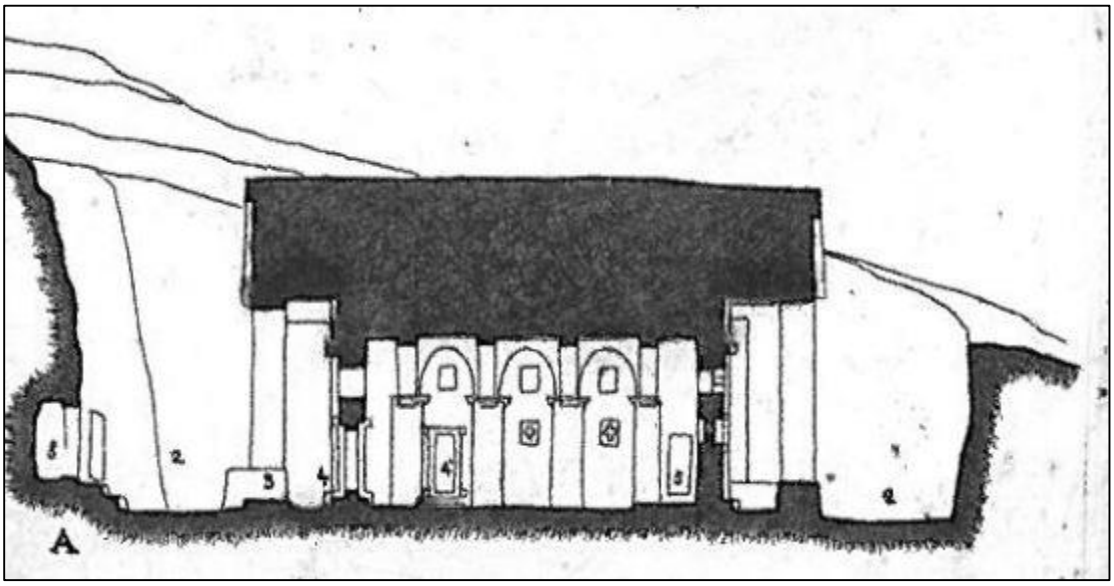
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