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A COMPARISON BETWEEN THE ROCK-HEWN CHURCHES AND GEOLOGY OF TIGRAY AND THE HYPOGEAN CHURCHES AND GEOLOGY OF AMHARA (NORTHERN ETHIOPIA)

Abstract - L. Lupi, *A comparison between the rock-hewn churches and geology of Tigray and the hypogean churches and geology of Amhara (Northern Ethiopia).*

One of the largest temple complexes in the world is to be found on the northern Ethiopian plateau in the region of Tigray. It is made up of 121 rock-hewn churches that are scattered across the territory. They date from the 5th to the 14th century AD and are different not only for their architecture but above all for how their construction was adapted to the different morphological conditions of their locations. Their fundamental feature is that they were built exclusively from two lithotypes of arenaceous nature; the Enticho Sandstones of the Ordovician and the Sandstones of the Adigrat Formation attributable to the beginning of the Jurassic. The latter formation covers the former with the sole interbedding of tillites probably attributable to the Ordovician glaciation. Further south in the Amhara region, again on the Ethiopian plateau, there is the famous complex of the 11 hypogean churches of Lalibela dating from the 12th to 13th century. They were built using the technique of carving from top to bottom with subsequent shaping of the isolated mass. These consist of large ignimbrites and tuffaceous levels, the Amba Alaji Ryolites formation, of Miocene. This formation partially covers the enormous extension of the hard basalts (Volcanic Traps) of Ashang and Amba Aibai formation of Eocene-Oligocene. Carving the stone of these rock-types (the Enticho and Adigrat Sandstones and the Amba Alaji formations) is relatively easy. These works of art bear witness to the profound religiosity of the Ethiopian people, in particular of the followers of the Ethiopian Orthodox Church, originally connected to the Coptic Christian Patriarchate which followed the ancient Monophysite schism.

Key words - roch-hewn churches, hypogean churches, geological formations, Lower Palaeozoic, Paleogene, Neogene, Orthodox Coptic Churc, Ethiopia

Riassunto - L. Lupi, *Un confronto fra le chiese rupestri e la geologia del Tigray e le chiese ipogee e la geologia dell'Amhara (Etiopia settentrionale).*

Nella regione del Tigray sull'altopiano dell'Etiopia settentrionale si trova uno dei maggiori complessi templari del mondo composto da 121 chiese rupestri sparse sul territorio. Esse risalgono dal V fino al XIV secolo e sono differenti non solo per la loro architettura ma soprattutto per la necessità di un loro adattamento alle diverse condizioni morfologiche dei luoghi ove sono ubicate. Il dato fondamentale è quello di essere costruite esclusivamente con due litotipi di natura arenacea, le Arenarie di Enticho dell'Ordoviciano e le Arenarie della Formazione di Adigrat, attribuibile all'inizio del Giurassico. La seconda sormonta la prima formazione con la sola interposizione delle tilliti riferibili alla glaciazione probabilmente Ordoviciana. Nella regione dell'Amhara più a sud sempre nell'altopiano etiopico si trova il famoso complesso di 11 chiese di Lalibela del XII-XIII secolo. Esse sono state costruite con la tecnica di escavazione dall'alto al basso e successiva lavorazione dell'ammasso isolato. La formazione coinvolta è quella delle Rioliti di Amba Alagi, una formazione ignimbritica e tufacea, parte di un episodio esplosivo del Miocene, che sovrastano parzialmente le immense distese dei duri basalti dell'Eocene-Oligocene conosciuti come "Volcanic Traps", basaltic group of Ashangi and Amba Aiba. I vari litotipi usati, sia del Tigray che dell'Amhara, hanno in comune la relativa facilità di lavorazione. Queste opere d'arte si devono alla profonda religiosità del popolo etiopico, in particolare agli adepti della Chiesa Ordodossa etiopica, in origine collegata al Patriarcato Cristiano copto che ha anticamente seguito lo scisma Monofisita.

Parole chiave - chiese rupestri, chiese ipogee, formazioni geologiche, Paleozoico inferiore, Paleogene, Neogene, Chiesa Ortodossa Copta, Etiopia

Introduction

Ethiopia has many incredible impressive rock-hewn and hypogean churches; the former were dug in the rocky mountainsides and are mostly located in the central and eastern Tigray while the latter were dug in rocky soils and are all to be found in the area of Lalibela in the Amhara region.

It is thanks to the special devotion of the Ethiopians to the Coptic Orthodox Christian religion that these historical treasures were made however they are above all the result of nature's bountifulness which moulded the geomorphology of the area.

Leaving aside the historical, architectural and religious significance of these sacred sites (which is beyond the scope of this article) it is important to want to learn more about the characteristics and differences inherent in the geology of these structures. It is important to know about the geology of Ethiopia so as to be able to understand how this particular landscape was formed which allowed the rupestrian and hypogean churches to be made.

The fragmentation processes of the Pangaea supercontinent and later, as far as Africa is concerned, of the Gondwana supercontinent (Triassic 225 million years ago) led in the succeeding geological eras to the present 'temporary' arrangement of the continents. This process of fragmentation continues relentlessly.

The most active tectonics of the entire system are con-

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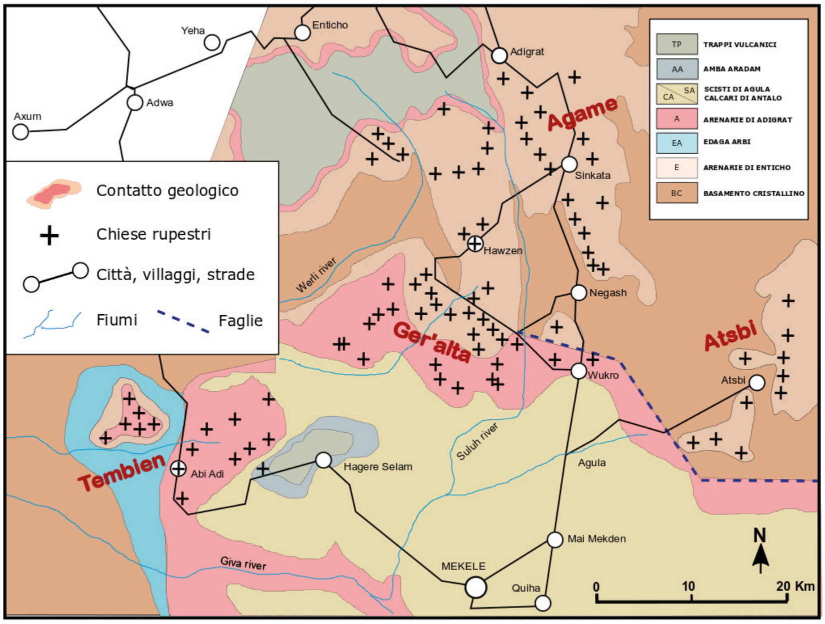

Figure 1. Simplified geological map of central and eastern Tigray with the positions of the various rock-hewn churches. It is clear from the map that the churches were all dug in Adigrat and Enticho Sandstone. (Map drawn by L. Lupi, 2020, www.dancalia.it).

centrated in the Horn of Africa, the northern portion of East Africa (comprising the area of Ethiopia, Eritrea, Djibouti, Somalia). These tectonics are due to the movement of the north-east-south-west of the Arabian plate away from the African plate. The movement of the plates began about 30 to 25 million years ago (Oligocene). Plateau regions such as Tigray and Amhara are set in this important complex geo-tectonic landscape and their terrain is the result of the successive depositions of huge layers of rocks of various kinds that provide evidence of the various events that have occurred to date. The geology of Ethiopia is well known thanks to the early studies of Italian scientists such as Giotto Dainelli and Olinto Marinelli (Geological Mission of 1904-05 and others in the 1940s), Giovanni Merla and Enzo Minucci (in 1938) and in the 1970s Bruno Zanettin and others. They were among the first to study these geological formations and attribute names to them. Many others have studied and written about the Horn of Africa and these studies continue.

The rock churches of Tigray

Tigray is located in the northern portion of the plateau and the region is home to 121 rock-hewn churches. They are thought to be the largest single group of rock-hewn architecture in the world. Eighty of these churches date from the 5th to the 14th century AD. These churches are found in four areas - Atsbi, Ger'alta, Agame and Tembien (Fig. 1). The churches are of different ages, sizes and histories, however they all have one thing in common; they are all carved in sandstone and not in other rocks present in the area (Fig. 2).

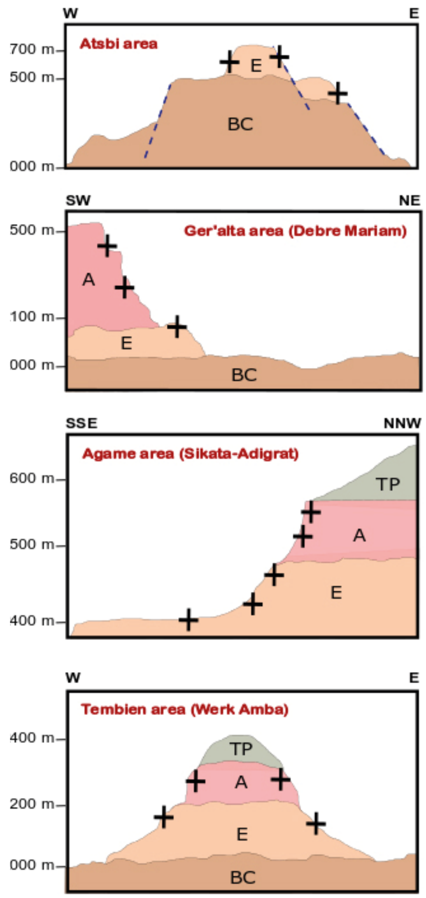

Figure 2. Cross-sections of the four areas where rock churches are found in Tigray that are discussed in the article and shown in the map in Figure 1. BC) Crystalline Basement, E) Enticho Sandstones, A) Adigrat Sandstones, TP) Volcanic Trappings (drawn by L. Lupi, 2020, www.dancalia.it).

PERIODO (ERA)	ETÀ (Ma)	UNITÀ GEOLOGICA	TIPOLOGIA DI ROCCIA
OLOCENE - PLEISTOCENE (Quaternario)	Presente - 2.58 Ma	**DEPOSITI ALLUVIONALI**	Limo, sabbia, ghiaia
NEOGENE (Cenozoico 65.05 – 2.58 Ma)	- 23.03 Ma	**DOLERITE DI MACALLÈ** *(Mekele Dolerite)*	Intrusioni di rocce femiche subvulcaniche (Dicchi, Sills e batoliti di piccole dimensioni) attraverso le altre rocce
PALEOGENE (Cenozoico 65.05 – 2.58 Ma)	- 65.05 Ma	**TRAPPI VULCANICI** *(Trap Volcanics)*	Enormi colate laviche di Basalti, Trachiti e Basaniti (Oligocene-Eocene) che da 45 a 25 Ma hanno coperto l'altopiano etiopico e tutte le formazioni precedenti
GIURASSICO (Mesozoico 251- 65.5 Ma)	-145 Ma	**AMBA ARADAM** *(Ambaradam Formation)*	Formazione composta da Arenaria fluviale e scisti, compatta e variegata (arenaria superiore)
		ARGILLITI DI AGULA *(Agula Shale)*	marna e scisto con calcare nero minore e sottili letti di gesso e dolerite
		CALCARI DI ANTALO *(Antalo Limestone)*	calcare, marna, scisto, intercalazione di gesso, in aree fossilifere
	- 201 Ma	**ARENARIE DI ADIGRAT** *(Adigrat Sandstone)*	arenaria da fine a grossa, stratificazione incrociata, siltiti, arenaria calcarea minore, limo ferruginoso e argilla (arenaria inferiore)
ORDOVICIANO (Paleozoico 542 – 252 Ma)	- 443.8	**EDAGA ARBI** *(Edaga Arbi Glacials)*	tilliti (sedimenti morenici deposti da un ghiacciaio) con grossi massi granitici e siltiti
	- 485,4	**ARENARIE DI ENTICHO** *(Enticho Sandstone)*	arenaria calcarea con lenti di conglomerati e tilliti, con fossili
PRE CAMBRIANO (542 Ma – 4.6 miliardi di anni fa)		**BASAMENTO CRISTALLINO**	Rocce vulcaniche e sedimentarie che poi erose e metamorfosate hanno formato marmi, gneiss, quarziti, ardesie etc..

Figure 3. Table showing the geological sequences that occur in the rocks of the Ethiopian Plateau and the Tigray region with the same colour scheme used in the map (Fig. 1) and in the cross sections(Fig. 2) showing the positions of the rock churches (drawn by L. Lupi, 2020, www.dancalia.it).

There are very ancient formations at the base of the stratigraphic successions of the entire Ethiopian Plateau. The Precambrian basement or crystalline basement was formed at the time of Pangaea and Gondwana, more than 600 million years ago. It is composed of essentially volcanic and sedimentary rocks that later eroded and metamorphosed to form gneisses, quartzites, slates, marbles, etc. The basement rocks were extensively folded and fractured before the later series were deposited.

The ice began to melt after long glaciation period of the Precambrian and the sea level began to rise. Then during the Palaeozoic and Mesozoic a dense sequence of continental and then marine sediments was deposited on top of the Precambrian crystalline basement. This formed the different rock strata in which the rock churches of Tigray have been excavated. This was followed by compressional events (ending in the Palaeogene Period, 65 to 23 Ma) that raised the mountains and the land was shaped by weathering.

The sedimentary succession begins with rocks of Palaeozoic age, and more specifically in the Ordovician period (485.4-483.8 Ma) with the sedimentary sequence of the Enticho Sandstone formation spreading from north-eastern Tigray to south-central Eritrea with a thickness of up to 150 metres (Fig. 4). These are calcareous sandstones rich in coarse-grained quartz deposited in the shallow seas surrounding the ice shield of northern Gondwana, and rich in marine fossils and primitive plant spores. It is in this Palaeozoic formation that most of the rock churches of Atsbi and Sinkata (A. Enticho) are excavated and also some of the churches of Geralta.

The Edaga Arbi Glacials formation consisting of moraine sediments, called tillites, deposited by glacier melting and varying in thickness of between 150 and 180 metres, is also deposited in the same period. These sedimentary rocks emerge in a circular area around the town of Mekele within a radius of 40 to 50 km; one of the rare locations in the world where these Palaeozoic glacial and fluvio-glacial deposits can be observed.

Figure 4. Ger'Alta Massif (photographed from the Ger'alta lodge) composed of Enticho Sandstone, south-west of Hauzien (Hawzen), where there are many rock churches that can only be reached by climbing using ropes.

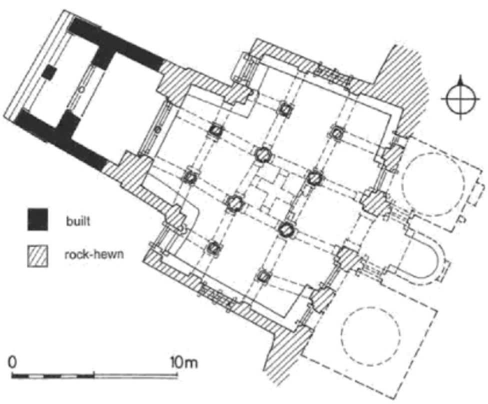

Figure7 e 8. Above: A lateral view of the entrance to the rock church of Abraha-Atsbeha and the sandstone rocks in which the interior is carved. Below: Floor plan drawing (by David W. Phillipson, in *The Oxford Handbook of African Archaeology*, 2013).

Figure 5. Adigrat Sandstone in the vicinity of the Abraha-Atsebaha church.

Figure 6. High among the rocks, with its white-coloured outer wall, the rock church of Abraha-Atsbehawas carved in the Adigrat Sandstone, the main formation of the Ger'alta area.

Figure 9. Front view of the entrance to the rock church of Gebre Mikael, 16 km from Mekele. On the right side of the front one can see the cross-layering of the Adigrat Sandstone.

At the beginning of the Triassic (in the Mesozoic Era) the supercontinent Gondwana began to divide again-giving rise to a second phase of rift events (Wolela, 2008), that is the fragmentation of the Earth's superficial crust and the subsequent drifting apart of the various portions due to the distensional push of the Mantle convection currents.

The continental phase that lasted almost the entire Palaeozoic era, with the deposition of the two above-mentioned formations, created a large plain. A coastal environment was formed later in the Jurassic period (201-145 Ma) following a marine transgression which was caused by the subsidence of the Horn of Africa. This environment had alluvial deposits and sandy coastal sediments that were deposited on top of the plain formed by continental and Triassic deposits (Blanford, 1869). All these formations are known as the Mesozoic sedimentary sequences and are formed by four geological units.

The earliest sedimentary sequence of the Jurassic (also Mesozoic Era) is the Adigrat Sandstone formation which is a medium-grained, rounded sandstone with neat, well-ordered sand grains, characterised by a wide range of reddish colours and divided into three parts (Fig. 5); a very friable lower part containing clay layers, a harder intermediate part often forming white to dark red vertical rock walls, and a white sandy upper part.

Figure 10. Detail of the inner walls of the church of Gebre Mikael that reveals 'cross-layering' and the coarse-grained composition of the Adigrat Sandstone. At the bottom the inclined laminae (foreset) of an older deposition along the layers of the river escarpment are clearly visible. Above, the horizontal laminae (bottomset) of a more recent deposition that occurred beyond the river delta embankment behind the previous depositional event.

Figure 11. Façade and side view of the Wukro Cherkos church, carved into the Adigrat Sandstone in the Hawzen-Ger'alta area, showing the cross stratifications that form in the foreshore area of a marine environment.

Figure 12. A column of the church of Wukro Cherkos carved in the rock; the undulating stratifications of the Adigrat Sandstone can be seen.

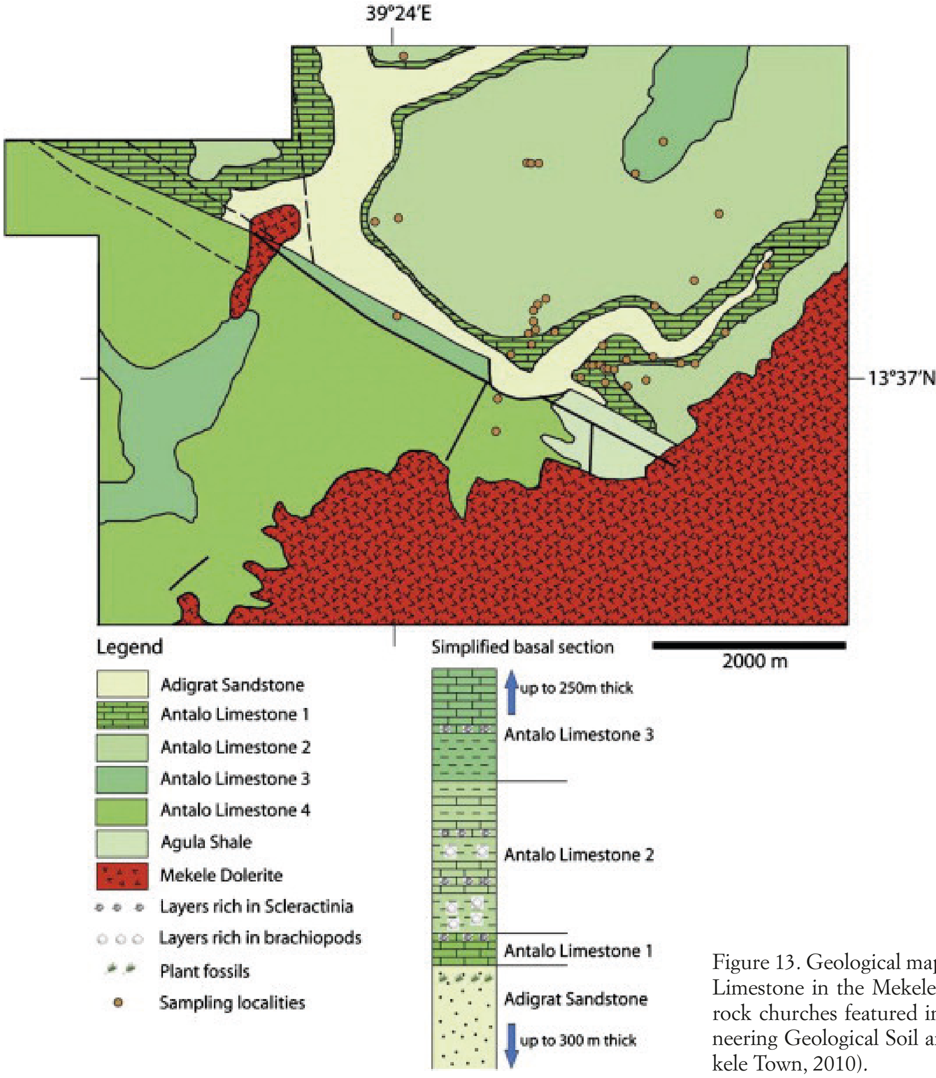

Figure 13. Geological map and simplified section of the Antalo Limestone in the Mekele region just south of the area of the rock churches featured in this paper (from Berhane G. Engineering Geological Soil and Rock Characterization in the Mekele Town, 2010).

The layers are 10 to 30 m thick and have 'cross-stratification'. The total thickness of the formation is between 300 and 600 m (Tesfamichael *et al.*, 2010). A large part of the Adigrat formation was deposited in a shallow sea, as evidenced by the presence of fossils typical of brackish waters and the shallow marine environment (bivalves, foraminifera and even marine crocodiles), and partly deposited in a continental environment. It is in this Adigrat formation that the process of erosion and shaping of the Tigray mountains began which led to the current formation. A large number of Tigray's rock churches are dug into the Adigrat Sandstone especially those in the southern portion of the Ger'alta, and the Tembien area (Kola Tembien and Dogu'a Tembien, etc.) e.g. the church of Abraha-Atsebaha (Fig. 6, 7 and 8); that of Gebre Mikael(Fig. 9 and 10) and of Wukro Cherkos (Fig. 11 and 12).

The second Jurassic sedimentary sequence called the "Antalo Limestone Formation" is substantial with total thickness estimated between 700 and 800 metres (Fig. 13, 14 and 15). The continuous subsidence of the Horn of Africa caused successive and multiple transgressions of the Indian Ocean during the Jurassic. This formation is characterised by marine sediments consisting of a lower, more calcareous, fossiliferous part with bivalves, corals, gastropods and echinoderms (Fig. 15) and an upper part is characterised by yellow marl, brachiopods and oolitic limestone. This limestone is the primary material from which the houses of Tigray are built. The marine environment lasted until the end of the Jurassic and, in addition to limestones, black shales, terrigenous marls (i.e., composed partly of limestone and partly of clays) were also deposited and formed the third sequence called "Agula Shale Formation". In contrast to the Antalo Limestone, the Agula Shales contain more clayey marls than limestone and some brachiopods and gastropods can be found in them, which made it possible to date them; ripple marks left by waves

Figure 14. Sedimentary sequence of the Antalo Limestone that emerges along the course of the Sabba River that runs from the base of the Ethiopian highlands to the Danakil Depression.

Figure 15. Antalo Limestone with fossils.

on the shoreline can often be seen in the layers (Beyth, 1972). The second (Antalo) and third (Agula) sequences make up the so-called "Antalo Succession" (Fig. 16) and they are often depicted together on geological maps because they are part of the same Jurassic depositional system associated with the marine ingressions and regressions that deposited these strata.

In the Upper Jurassic the Ethiopian continent began to rise again, the Indian Ocean receded and this was followed by the deposition in shallow water or in a subaerial environment of layers of a silty or clayey sandstone on top the Agula Shale Formation. This formation of strata, called 'The Upper Sandstone' by Giotto Dainelli (1943), is known as the "Amba Aradam Formation". The entire Horn of Africa area was characterised by enormous fractures at the peak of the Mesozoic geological sequence in the Cenozoic (or Tertiary) era, Paleogene period (65.5-23.03 Ma), starting from the Eocene and up to and including the Oligocene. These fractures caused intense and widespread volcanism. From 45 to 25 million years ago enormous lava flows of immense depths of up to 2000 metres, called Volcanic Trap formations (basalts, trachytes and basanites), covered the Ethiopian and Somali plateau and the southern part of Yemen all of which at the time were adjacent to each other.

Figure 16. Layers of the Antalo Succession sedimentary sequence on the edge of the road from northern Danakil (Amhed Ela, Berahle) to Wukro in Tigray.

All of the sedimentary formations described above were covered by Tertiary Volcanic Traps and are sometimes crossed by veins and dikes of what is known as Mekele Dolerite (Fig. 13 and Fig. 17 and 18). This igneous rock, which was formed in the same period but later than the huge basaltic flows, came from great depths and became wedged in the fractures of the rocks and slowly cooled. Particularly in the area north of Mekele the dolerite was wedged mainly in the soft formation of the Agula Shale. The area around Mekele, including the area covered in this paper, is criss-crossed by numerous basaltic intrusions most of which range in thickness from 0.5 to 30 metres, although smaller intrusive entities are also common (Levitte, 1970). The rocks are black, fine to medium-grained and very hard.

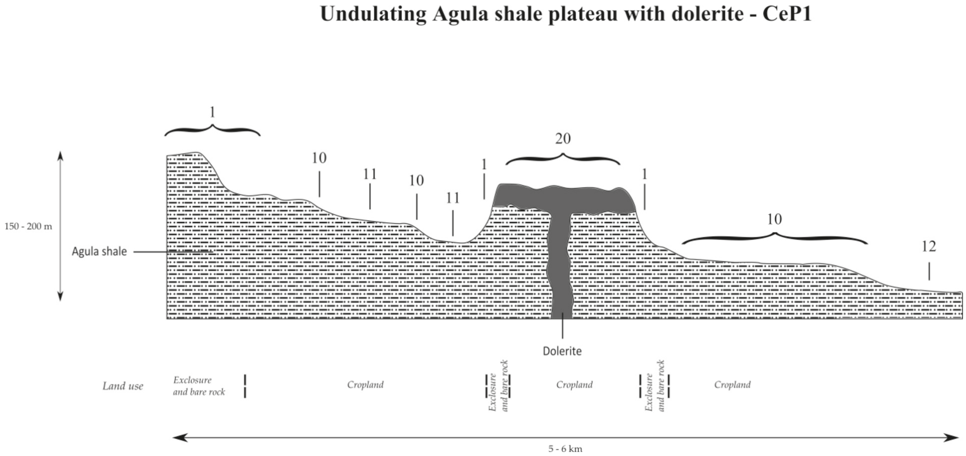

Figure 17. Schematic diagram of the rise of an intrusion of Dolerite that cuts through the strata of the Antalo Succession, in particular the AgulaShale, settling above them.

Figure 18. A doleritic intrusive vein running through the sedimentary strata of the Antalo Succession. In the Mekele area.

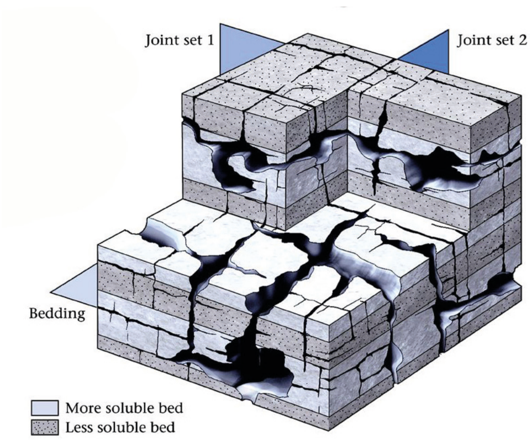

Figure 19. Diagram showing typical fractures in sedimentary rocks caused by wind, water and changes in temperature caused and the different degrees of erosion.

Steep rock walls

The sandstones of the Palaeozoic and Mesozoic are very compact and homogenous and intersected by an orthogonal network of lines and fractures that converge at specific points. The tectonic uplifts of the Ethiopian highlands (which initiated the formation of the Rift Valley 30 to 20 million years ago during the Cenozoic) caused huge fractures that cut deeply by rivers formed rectangular blocks separated from each other (Fig. 19). Isolated plateaus (*mesa*), hills and pinnacles up to 300 metres high were formed in a manner similar to the Grand Canyon. During the process of 'differential erosion', in addition to the significant impact of glaciers and rivers, that of wind, water and temperature also played a decisive role. Rainwater and water from melting glaciers flowed deep into the cracks in the rock created by the tectonic uplift, and with the extreme change in temperature, the fractures widened on freezing. The waters of the heavy rains continued the work by eroding the layers, large gaps between the rock massifs were the result. The large variation of temperature, typical of desert and high mountain areas, with the repeated expansion and contraction of the surface portion of a rock as it heated up and cooled down, also created minor fractures (thermoclastism) that were later eroded by other weathering agents. Finally, winds eroded the limestone and sandstone. The softer layers were rapidly eroded, the harder rocks resisted erosion and the vertical wall remained (Fig. 20). The Tigray plateau hasan average elevation of about 2000 metres and it is a natural extension of the Ethiopian plateau to the north. It overlooks another vastly different world, the Danakil which is part of the same tectonic process but is completely different and has a much more recent geology. The transition from one region to the other is momentous: it goes from the Tigray mountains that can sometimes exceed 4000 metres to the Danakil depression that is as low as -120 metres below sea level. Two contrasting worlds, one high up above, the other below, one with an ancient geology and the other with a much younger geology (from the Miocene 23.03-0.3 Ma up to the Holocene (our period), one Christian world and the other Muslim, one with water and crops and the other a desert consisting of lava, salt and sand.

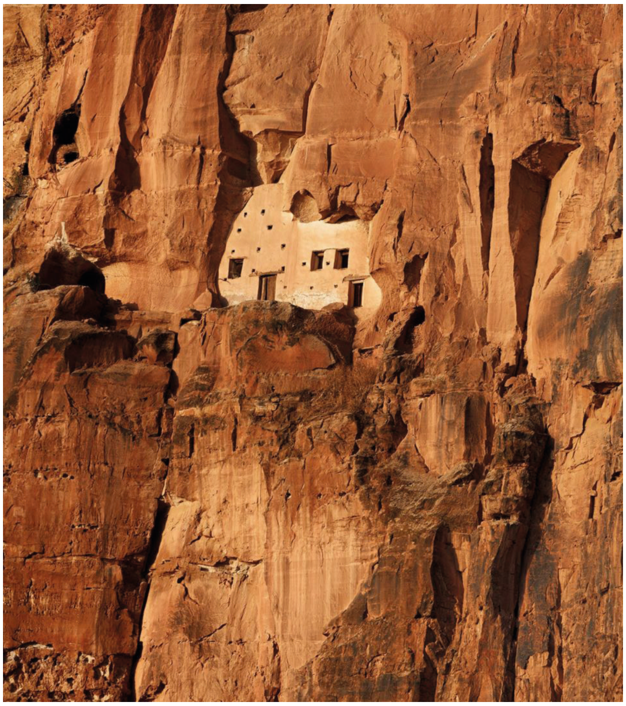

Figure 20. Vertical walls of the rock church of Abba Yohani, located 13-14 kilometres from the town of Abi Adi, about 60 km west of Mekele. Situated in the middle of a 300 metre rock face, to reach it one has to climb up steps and ledges for about half an hour.

Figure 21. A view of the outside of Saint George's Church (Bete Giyorgis).

Figure 22. Inside the church of Saint George (Bete Giyorgis) which is carved out of the red ignimbrite tuff of Lalibela.

The hypogean churches of Lalibela

The hypogean churches of Lalibela in the Amhara region are monolithic churches located in the western Ethiopian highland near the city of Lalibela, which was named after King Gebre Mesqel Lalibela of the Zaguè dynasty. In the late 12th and early 13th Century the King commissioned the large-scale project of the construction of eleven churches to recreate the holy city of Jerusalem in his kingdom. The site is still used by the Ethiopian Orthodox Christian Church and it is an important place of pilgrimage for devote Ethiopian christians to this day. The tradition of carving in stone to create places of worship began in Tigray and the hypogean churches in Lalibela (Fig. 21 and Fig. 22) appear to be sandstone and because of their colour and textureone could mistakenly think that the same rock was used. The churches in Lalibela are very different and it is again geology that provides the answer. The Tigray rock churches were only excavated in two sandstone formations (Enticho and Adigrat), that is in sedimentary rocks, whereas the monolithic churches of Lalibela are excavated in rocks of volcanic origin of a much more recent era. Both of these rocks are very compact and at the same time relatively easy to excavate. The geological map (Fig. 1) shows us that large amounts of Palaeogene lava flows (Volcanic Traps) were deposited on top of the predominantly sandstone sedimentary sequences of the Palaeozoic and Mesozoic periods which covered 70% of the Ethiopian Plateau from 45 to 25 million years ago. In the Lalibela area volcanic rocks from the same period (named "Traps") are of basaltic groups of "Ashangi and Amba Aiba". 25 to 10 million years ago other products resulting from explosive volcanic activity were deposited on top of these lavas in the Amhara area but not in Tigray (Fig. 23). The Lalibela area is in fact located on top of a tuffaceous *ignimbrite* formation called the "Amba Alaji" or "Amba Alaji" Ryolites.

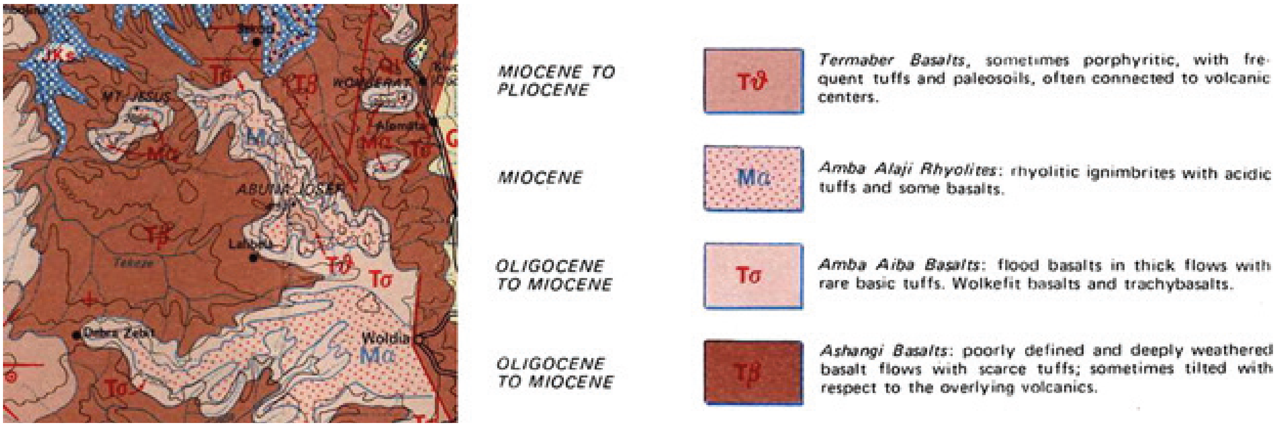

Figure 23. Extract from the geological map of the Lalibela region (after Merla *et al.* 1979). The Cenozoic volcanism of the northwestern Ethiopian plateau is subdivided into four formations (Berhe et al., 1987); the basaltic Ashangi and Amba Aiba units (forming part of the Volcanic Traps), topped locally by the ignimbritic Riolites unit of Amba Alaji (Zanettin, 1992), and in other places covered by other Miocene basalts of the Termaber unit.

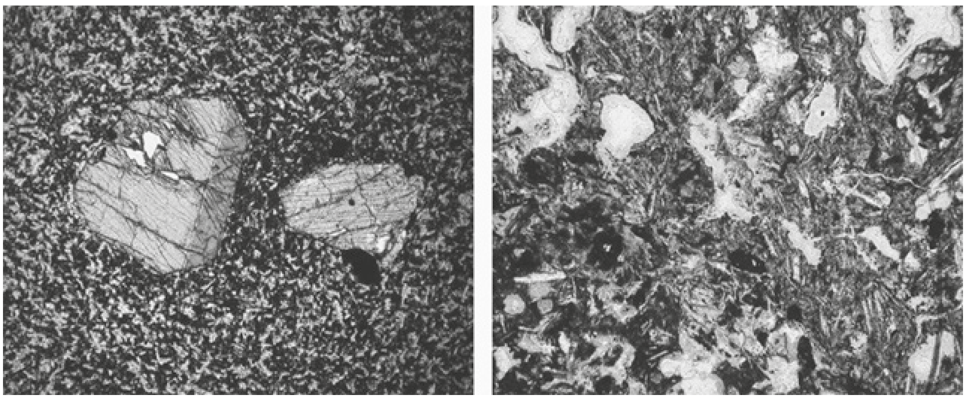

Figure 24. Thin section of basalt (left) and weathered tuff (right), (Delmonaco *et al.*, 2009).

The volcanic material of rhyolitic origin, i.e. very acidic and rich in silica (SiO_2), was deposited as 'ignimbritic' flows (a type of very powerful explosive volcanic event) very similar to that which the "Campi Flegrei" produced 39,000 years ago and which covered the two thirds of the Italian region of Campania with tuff layers up to 100 metres thick.

The isolated block of red volcanic tuffin Lalibela floats like a cork above a sea of basalt that predominates in the plateau area. The ancient Ethiopians who dug the churches knew the difference between the compact tuff that is easy to work (like sandstone) and the hard basalt of the volcanic traps (Fig. 24).

All the churches in Lalibela were excavated from top to bottom starting from ground level and going down to 15 metres. Using hammers and chisels the faithfuls dug trenches surrounding the monolithic and semi-monolithic structures and then created a system of tunnels connecting the two groups of churches.

Conclusion

In the Tigray and Amhara regions, in the Ethiopian Plateau, there are two of the most notable temple complexes in the world. They were built with different materials: sedimentary lithotypes from the Paleozoic - early Mesozoic those from Tigray (Sandstones of Enticho and Sandstones of Adigrat), ignimbritic tuffs those from Amhara, of much more recent age, Miocene. The former were built from the 5th to the 14th century, the latter between the 12th and 13th century. The construction technique is also different, since in Tigray the churches are of different shapes from each other depending on the different morphology of the places where they are located, while those of Lalibela in Amhara are homogeneous as they were built in a very specific period and space, with the technique of carving from top to bottom and subsequent shaping of the isolated blocks. The churches of Tigray and Amhara, however, are comparable in that ther builders have chosen softest lithotypes from the variety of Ethiopian geology, but above all in that they were inspired by the common Coptic Orthodox Christian faith which had already in ancient times followed the Monophysite schism.

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