Finding Local Stone for Façade Renewal in Finiq, Albania

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Abstract- *The municipality of Finiq, located in southern Albania, is grappling with a multitude of challenges, including a declining population, isolation, and a diminishing sense of community identity. The town is marked by abandoned buildings and a lack of uniformity among the inhabited structures, resulting in an identity-less appearance. Recognizing the significant impact of facade aesthetics on residents' perception of the urban landscape, and acknowledging the historical bond between humans and stone, this study aims to identify a local stone for facade renovation in Finiq to enhance the homogeneity of the buildings' appearance, to contribute to addressing the important issues affecting the town of Finiq. The research methodology involved a comprehensive review of scientific literature pertaining to regional geology, stratigraphy, rock type quality, and the accessibility and proximity of the site under investigation. Limestone, abundant in the region and historically associated with the village of Finiq, has been identified as a potentially suitable building stone for this town.*

Keywords:
Finiq Municipality, Geo-resources, Quarry, Limestone, Façade.

Introduction

The municipality of Finiq, located in the southern region of Albania (Fig1), is grappling with a series of significant challenges that have profound implications for its future.

Finiq has witnessed a consistent decline in its population over the years, resulting in a decrease in economic and social activities. This diminishing population has also led to a lack of vibrancy in public spaces, with fewer individuals frequenting them and a reduced provision of services within the town. The geographical isolation of Finiq is also a noteworthy concern, given its location in a remote area characterized by limited access to both public and private transportation networks. This circumstance makes accessing the city not particularly comfortable, thereby resulting in the restricted availability of essential services and opportunities. Consequently, these issues have contributed to the absence of a distinct identity for Finiq, impeding the community's ability to cultivate a sense of pride and belonging.

Finiq's proximity to the prominent urban center of Saranda, a popular summer tourist destination in Albania, presents intriguing opportunities for the revitalization of abandoned settlements and offers an economic lifeline for its inhabitants. However, it also presents a new challenge for the community, as it is unprepared for the possible new influx of tourists.

In Finiq the past migration trend has led to the abandonment of many residences where people used to live or of those that were under construction. Consequently, there are numerous buildings that, neglected for a long time, exhibit both architectural and structural decay, and others that remain in a semi-finished state (Fig2) In addition, the completed and presently inhabited buildings exhibit, among them, a notable lack of uniformity in terms of structure, form and, above all, Façades. This imparts a distinct impression that each resident has independently fashioned their residence according to individual aesthetic preferences, in the absence of a comprehensive land use planning framework. Consequently, this heterogeneity significantly contributes to the visual landscape of the town, manifesting a discernible absence of a cohesive identity, particularly evident to the observant visitor. It is therefore conceivable that this stems from the absence of a sense of identity among the population. Simultaneously, it is plausible that this factor itself contributes to instilling in the perception of the local population a sense of identity deficiency.

For what concern Façades, while it may appear to be only a matter of aesthetics, they represent one of the features of the environment and urban landscape (Jalali et al., 2013; Kalaga, 2010). Façades act as a crucial link between the interior and ex-

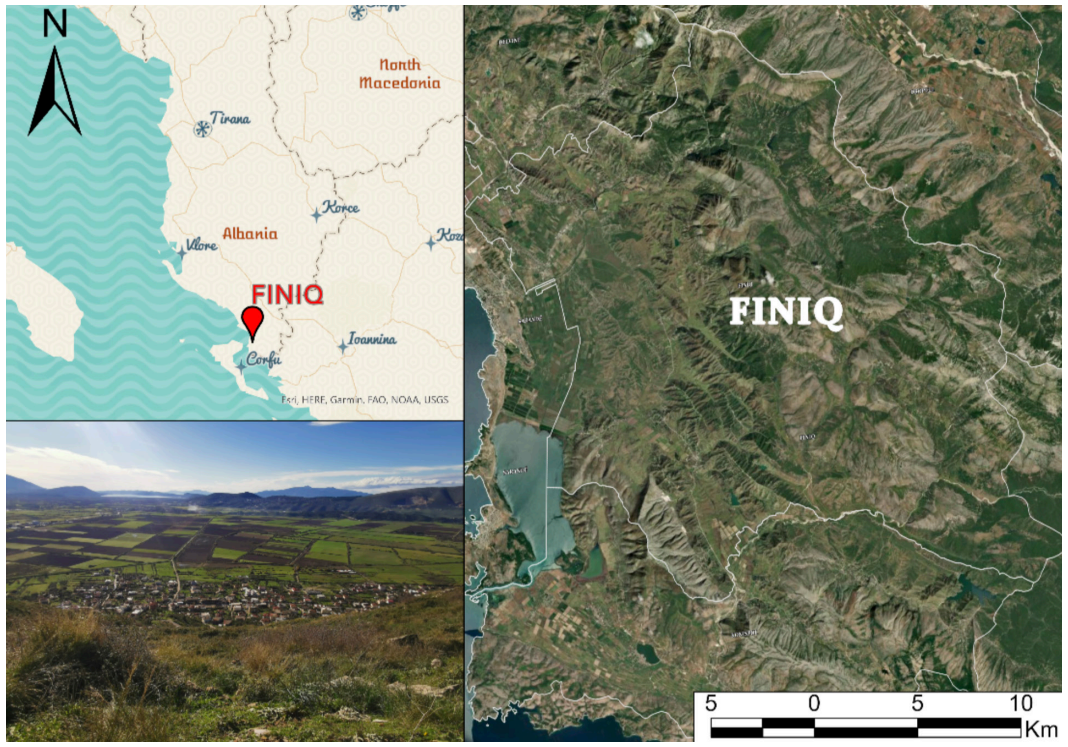

Fig1 / Satellite image showing the area of Finiq municipality. In the image on the bottom left, a photo from above of the town of Finiq source /

Fig2 / Example of semi-finished building in the Finiq municipality
source /

Fig3 / An example of Domus de Janas in the territory of Buddusò
source /

terior environments (Hayashi, 2004), defining the representation of the city's face. The different visual elements of Façades can generate different feelings and emotions in the people in contact with them:

- Form is very significant in landscape and façade design, as highlighted by various studies in which form is considered a key element influencing façades and historical city images (Kaplan, 1975; Baper & Hassan, 2012; Jalali et al., 2013; Askari et al., 2014).
- Colors are among the main factors that influence the design of views, alongside form and texture (Baper and Hassan, 2012). Gjerde (2010) further posits that colors shapes the aesthetic pleasure of individuals at both unconscious and cognitive levels.
- Decorations and details are integral visual elements in the assessment of building façades, as they contribute significantly to the architectural identity and aesthetic appeal of a structure. These elements are considered as potent aspects of façades, playing a crucial role in maintaining the continuity of architectural identity (Baper and Hassan, 2012).
- Materials used in building Façades play a primary role. They are considered as fundamental visual elements in the perception and evaluation of urban spaces by citizens and users. Along with form, style, and color, materials can significantly influence the formation of urban historical images (Askari et al., 2014; Kaplan, 1975). Materials are an important element affecting the continuity of architectural identity (Baper and Hassan, 2012).

In terms of materials, although its use has diminished in contemporary times, stone has been the fundamental element both for the construction of buildings and for their external appearance for much of human history. The history of stone is intertwined with that of architecture. Stone, with its deep-seated roots as a construction material and a symbol (Strickland, 2010), holds a significant place in various cultures and religions. It is esteemed and utilized in fine art, architecture, and enduring monumental structures. Beyond its tangible attributes of durability and versatility, stone has been employed to represent power, opulence, wealth, divinity, universality, and the triumph over adversities (Lloyd 2010; Mero et al. 2011; Wright 1928). Furthermore, the incorporation of stone in valuable monumental and architectural designs amplifies its symbolism and portrayal (Shareef and Sani, 2020).

In many European regions, stone materials have characterized traditional construction culture and the historic built environment. In Italy, in particular, many smaller urban centers and larger urban areas are constructed using stone as the primary and most important material. Each of these areas is characterized by particular types of stone, as in earlier times it was customary to use materials found in the local area. Some examples are the "Leccese" stone Façades in Salento, or the roofs and dry-stone walls in "slate" stone in Liguria. Furthermore, the variety of stone in the panorama of the Italian peninsula has contributed to strongly differentiate and characterize even geographically close urban areas such as Syracuse, Catania, and Messina in the Sicilian region or Sanremo, Genoa, and Savona in the Liguria region (Rodorico, 1965). The use of the same stone materials for different construction elements contributes to achieving harmony, so much so that these urban centers were defined as masterpieces of art (Rodorico, 1965).

Another example of the relationship that can come between man and building stone is that of the municipality of Buddusò in Sardinia, Italy. This municipality is situated within a significant ornamental granite extraction district. In this place granite almost exclusively serves as the sole construction stone, making the use of this building material a distinct local characteristic. Moreover, this engenders a certain continuity with the important archaeological sites in the area represented by the Domus de Janas, ancient tombs (Neolithic-Bronze Age) excavated by hand (Fig3). In this municipality, a sense of belonging is intimately tied to granite, to the extent that many events and festivals are dedicated to the culture of granite.

In the context of what has been reported previously, this study aims to identify types of local stones that can be used for Façade renovation in buildings within the municipality of Finiq. This, in order to suggest a way to counteract the marked heterogeneity in the buildings of this town, which contribute to exacerbating the problems that plague the site under consideration. In this light, the expected results of this work are not aimed at resolving the issues faced by this town, but rather at providing a tool that can aid in addressing these challenges.

In conducting this study, an approach based on in-depth analysis of the geology of the area of interest was adopted. This analysis involved consulting scientific literature and existing geological data to gain a comprehensive understanding of potential geological resources. This analysis focused on identifying possible geological resources and comprehending the geological characteristics of the area, taking into consideration various factors such as rock type, quality, accessibility, and distance from the Municipality. Concurrently, the consulting of scientific literature on geotechnical and environmental analysis was conducted to assess the feasibility of using different construction materials, considering aspects related to geotechnical stability and environmental impact.

Geology of Albania

From a regional geology perspective, Albania falls within the southern sector of the Alpine orogenic system. The Shkodra-Peje transversal fault marks the boundary between the Dinarides and the Hellenides. Albanian geologists commonly refer to the geological structure encompassing Albania as the Albanides. The Northern Albanides extend into what was formerly Yugoslavia, aligning with the Dinarides, while the Southern Albanides continue southward into Greece, merging with the Hellenides (Meçe et al. 2000, Xhomo et al. 2002).

Within Albania's territory, several inland tectonic zones are present (Fig4), including the Korab Zone (Pelagonian), Mirdita Zone (Subpelagonian), Albanian Alps

Zone, Vermosh (Bosnian Zone), and Gash Zone (Durmitor Zone). Additionally, external tectonic zones encompass the Sazan and Ionian Zones (where Finiq is located), Kruja Zone (Gavrovo), and Krasta Zone (Pindos). These tectonic zones exhibit a gradual overthrusting pattern towards the west (Eftimi, 2010).

Despite its relatively small size, Albania boasts a diverse range of geological formations from various geological epochs. These formations include rocks dating from the Ordovician to the Quaternary, encompassing sedimentary, magmatic, and less common metamorphic types. Notably, carbonate sedimentary rocks from the Devonian to Burdigalian age give rise to numerous large and small anticline and syncline structures scattered throughout the tectonic zones (Eftimi, 2010).

The Oligocene to Pliocene molasses sediments, primarily composed of heterogeneously intercalated sandstone, conglomerate, siltstone, claystone, and clay layers, predominantly fill the Adriatic depression, as well as some inland depressions like the Albanian-Thessaly, which is the largest among them. Pleistocene-Holocene gravelly clayey deposits represent the most widespread geological unit in the Adriatic Basin, as well as in certain inland mountain plains and river valleys. Magmatic rocks are prominently present, particularly within the inland tectonic zones. The most extensive magmatic development is seen in the Jurassic ophiolitic magmatism of the Mirdita (Subpelagonian) zone, comprising mostly intrusive rocks with a lesser occurrence of volcanic rocks (Eftimi, 2010).

Albania is characterized by a pile of tectonic units consisting of both oceanic and continental-derived sequences. These latter testify the geodynamic evolution of the Jurassic Tethys Ocean basin, located between Adria (Apulia) and Eurasia plates, and related continental margin (Robertson & Dixon, 1984). This evolution regarded the continental Triassic rifting and the break-up along the northern margin of Gondwana, leading to the creation of Tethys Ocean basin during the Jurassic. After that, during the Middle Jurassic – Early Creataceous there was the subduction and obduction of the Tethys oceanic lithosphere. In this stage the oceanic lithosphere was deformed and thrust onto the continental margin.

In terms of stratigraphic aspects, at a regional scale, it is possible to identify the following rock formations (AKBN, 2019):

- Metamorphic rocks: consisting of terrigenous, effusive and rare carbonate rocks, they occur in the internal Albanides (Korabi zones) and they belong to Paleozoic age.
- Evaporites rocks: consisting of salts, anhydrites etc., belonging to Permian-Triassic ages. They are mainly encountered in the Korabi and Ionian tectonic zones.
- Ophiolites rocks: consisting of serpentinites, ophicalcites and intrusive magmatic rocks, they belong to Middle Upper Jurassic age, and they are widely spread in the Internal Albanides, especially in the Mirdita tectonic zone.
- Carbonates rocks: they are widely spread in the External an Internal Albanides. They are related to Mesozoic (Upper Triassic to Oligocene) age, and they are represented by limestone of different kinds and dolomites. Carbonate rocks in the Ionian zone belong to Upper Triassic-Eocene and are represented by pelagic facies. They reach thickness of 2850 m.
- Turbidites deposits: they are also known as Flysch they are divided into: Early Flysch, belonging to Upper Juras-

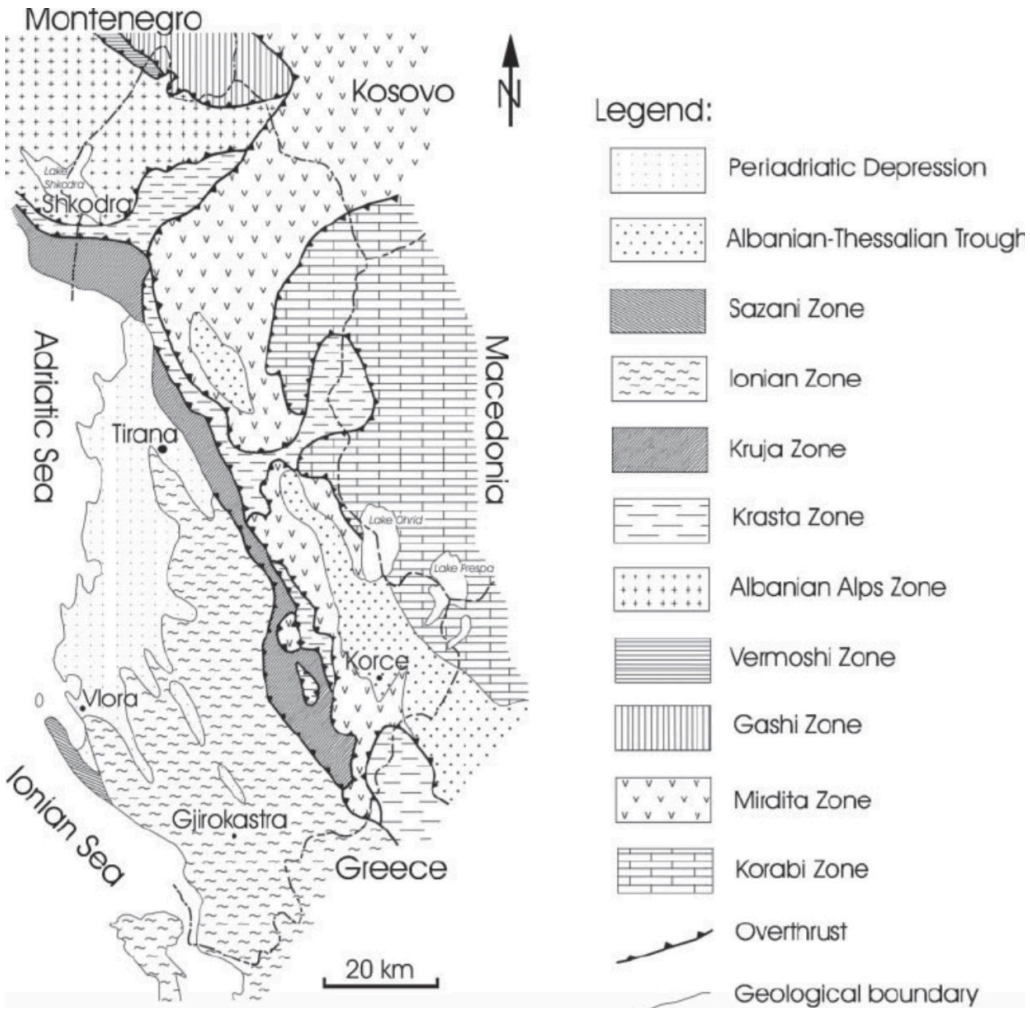

Fig4 / Overview of the geology of Albania source / Mece & Aliaj, 2000

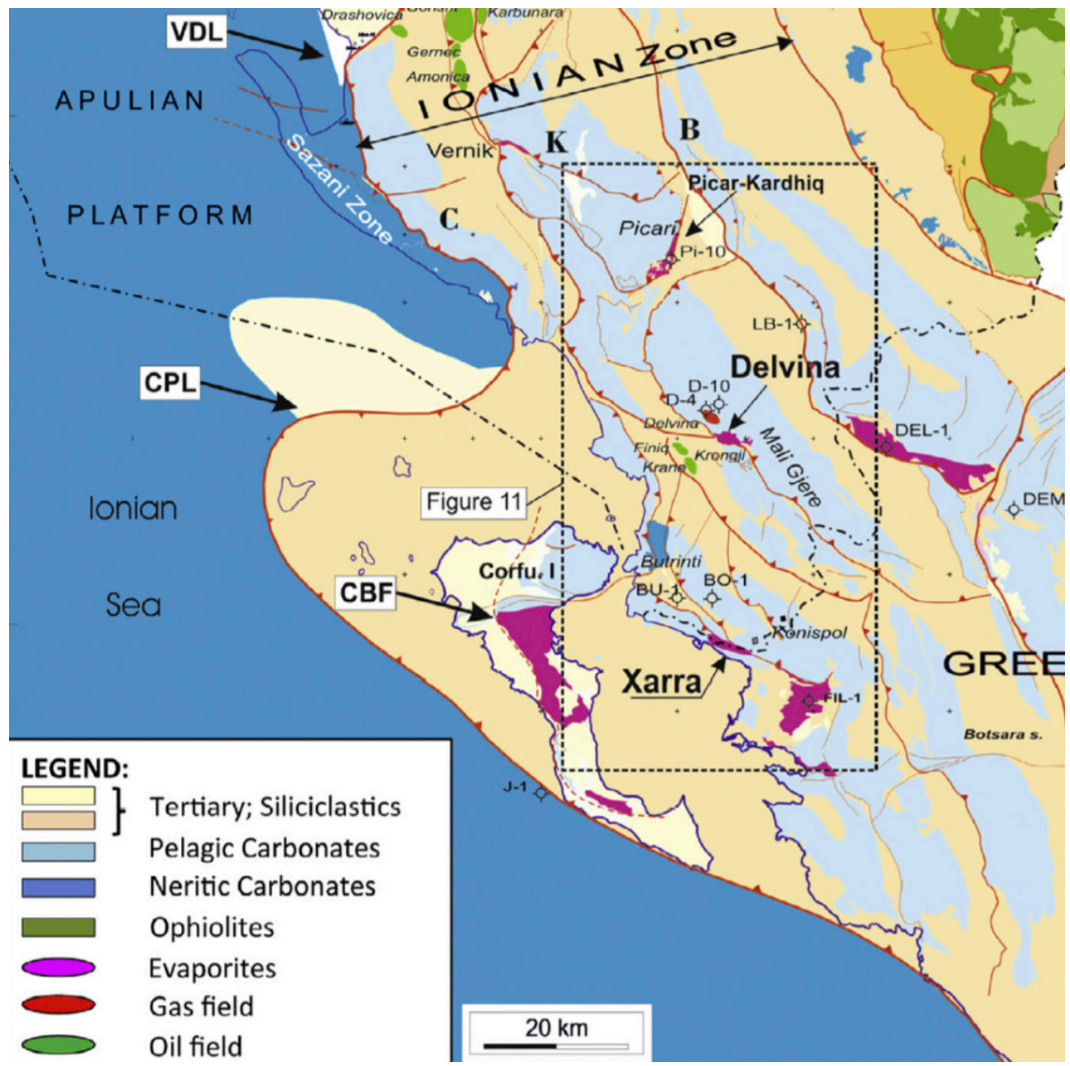

Fig5 / Simplified map of the Mesozoic carbonate platforms in southern Albania emphasizing the occurrence of the Triassic evaporites as well as the position of the oil and gas fields in the Ionian fold-and-thrust belt source / Bega & Soto, 2017

Fig6 / Left - view of the limestone fortification walls of ancient Phoenice in the archaeological park of Finiq, Right – the limestone stands in the theater at the Butrint archaeological site. source /

sic-Lower Cretaceous, occur in Krasta-Cukali and Mirdita Zones; Young Flysch (Maastrichtian-Eocene), that was formed in Krasta-Cukali and Albanian Alps. In the External Albanides (Kruja and Ionian zones) these turbidites deposits belong to Oligocene age and are widely spread on the surface with a total thickness varying between 1000 m and 3000 m.

- Pre-Molasses formation: consisting of marls, marl clays, sandstone, and lithotamnic and organogenic limestones, belongs to Acquitanian-Early Serravalian age. It is encountered especially in the western part of the Ionian zone and Sazani as well.

The oldest rocks within this zone are uppermost Triassic evaporites. These rocks have an approximate age ranging from the latest Ladinian to Rhaetian, dating back to 238–201 million years ago. They consist of reddish marls containing nodules of gypsum and anhydrite, as well as halite. Occasionally, there are layers of dolomite and fine-grained sandstones and siltstone within this formation (Bega & Soto, 2017).

The most significant exposures of evaporites in Albania are situated in the northern and southern parts of the Ionian zone (Fig5), particularly in the outcrops of Dumre, Picar-Kardhiq, Delvina-Krongji, and Butrint-Xarra (Roure et al., 1995; Velaj et al., 1999; Velaj, 2001; Jardin et al 2009; Prifti et al., 2013).

The carbonate section within the Ionian units maintains continuity throughout the Jurassic, Cretaceous, and up to the Eocene periods. Based on surface geology observations and seismic data along the Mali Gjere section, this Mesozoic carbonate section has an average thickness ranging from approximately 2600 to 3950 meters (Velaj, 2015a, 2015b).

Organic-rich shales are present not only in the Upper Triassic-Lower Liassic section, extending up to the Toarcian period, but also within the Middle Jurassic and Upper Cretaceous sequences, particularly from the Turonian onward. These shale deposits serve as important regional markers throughout the Mesozoic carbonate sequence (Roure et al., 1995).

Clastic sediments, predominantly consisting of turbidite sequences with alternating marls and fine-grained sandstones, constitute the Oligocene sequence. The source of these sediments was in the East, and their maximum thickness ranges from 1500 to 3000 meters. The transition from the Eocene to the Oligocene is often marked by a characteristic marl-rich interval, typically 20 to 50 meters thick, known regionally as the "transition marly interval". Lower to Middle Miocene deposits are primarily found in the central and northern Ionian Zone (Fig5), with an overall thickness usually less than 1000 meters (Bega & Soto, 2017).

Moving southwest, the Sazani or Apulia Zone becomes apparent in southern Albania. The stratigraphy of this region is characterized by a continuous sequence of carbonates ranging from Upper Jurassic to Upper Cretaceous in age. Neritic limestones predominate within this sequence, while dolostones are more common in the Upper Triassic and lowermost Jurassic packages. Overlying this carbonate sequence are shales, marls, and some sporadic fine-grained sediments of Lower Miocene (Aquitanian) age (Monopolis & Bruneton, 1982; Sejdini et al., 1994). The estimated thickness of the Apulian carbonate section in Albania is approximately double that of the total thickness of the Ionian carbonates.

For what concern decorative stones, these are abundant throughout the entire territory of Albania. These include various metamorphosed and partially metamorphosed sedimentary rocks and magmatic rocks. Among them, the following are particularly noteworthy: gabbros, troctolites, olivinites, and dunites, diorites, calcite marbles, dolomitic marbles, marbled limestones, marbled dolomitic limestones, marbled conglomerates, and brecciated limestones. Approximately 120 million tons of marble limestones have been estimated (Nako et al., 2000). These decorative stones exhibit a wide range of colors, spanning from white and light grey to dark red and rose, displaying various hues. In most of the deposits, these stones possess a natural state compressive strength exceeding 100 MPa (Nako et al., 2000).

The Sazan zone, the small region belonging to the westernmost part of the southern region, is characterized by Mesozoic neritic limestones and dolomites and Paleogenic Flyschoid sediments, overthrusting the Ionian Zone. The limestone of this area shows extremely pure calcium carbonate composition and uniform white color (Vaccaro & Vaso, 1998).

The Ionian zone is characterized by important marble-bearing district with finely layered white limestones in the Dervican-Lazarat, Grapsh, Skarfice, Butrint, Shkalle, Cuke, Himare, and Piqeras localities (Vaccaro & Vaso, 1998). Andriani et al. (2013) illustrated that Butrinti limestone exhibits excellent quality attributes owing to its aesthetic and technical characteristics. The stone's low porosity, high density, and strength render it exceptionally well-suited for outdoor applications in various environmental and climatic conditions. The impact of moisture saturation on its mechanical strength appears to be negligible.

Results

The territory of Albania is endowed with an extensive variety of stones, encompassing both sedimentary and igneous origins. These can be employed in the edification of structures, and in the context of this study, as material for Façades. Within the confines of Finiq, the utilization of igneous rocks such as gabbros, diorites, dunites, and so forth, would appear incongruous for two primary reasons:

- The regions where these rocks outcrop, albeit within the boundaries of Albania, are considerably remote from Finiq. This would consequently lead to an increase in costs attributed to transportation, coupled with an amplified environmental footprint associated with the transport of the material.
- Given the absence of igneous rock outcrops in the vicinity of Finiq, their use would be contextually inappropriate, and devoid of any correlation between the history of Finiq and igneous rocks.

In contrast, sedimentary limestone rocks are predominantly abundant in this re-

gion. Their usage seems fitting for the renovation of Façades within the context of Finiq. The benefits in terms of cost-effectiveness and environmental impact would be substantial, given the proximity and abundance of this type of stone in the area under study. Moreover, limestone also signifies a robust historical linkage with the ancient city of Phoenice. Infact, the structures within the near archaeological park of Phoenice are all constructed of limestone (Fig6). In addition to this, mention can also be made to the nearby archaeological site of Butrint, where numerous structures are built using limestone (Fig6).

Finiq, like the previously reported case of the town of Buddusò in Italy, has its own potential for such a connection with limestone. By recognizing the historical and cultural ties between the region and this stone, the community can foster a sense of pride and ownership over their architectural heritage. Moreover, the experience of Buddusò demonstrates that over time, a strong cultural association with a specific stone can extend beyond the material itself. It can become a driving force for the sustainable development of the region.

Insights gathered from the review of scientific literature indicate that in the vicinity of Butrint, the so-called Butrint Limestone exhibits both technical and aesthetic qualities suitable for Façade construction. Therefore, it could be a potential choice for use in Finiq. This study, however, found no information about active limestone quarries in the area. The existence of such quarries is crucial as they can provide a starting point for the potential selection of materials for Façade renovation within the Finiq municipality."

Conclusion

Limestone emerges as the most prevalent ornamental stone in the region. Indeed, compelling examples are provided by archaeological sites in the vicinity where limestone was historically utilized as a building material.

The use of limestone would primarily serve as a means to economize on construction materials, considering the proximity of material sources. This would help reduce transportation costs compared to possible imports from third-party countries or remote places in Albania, as well as reduce the environmental impact associated with the transportation of the material. Furthermore, the utilization of limestone in the Finiq area could also establish a connection with the archaeological site located just north of Finiq.

While it may be challenging to restore a sense of belonging through the use of limestone as a building stone in the Finiq territory, it can serve as a starting point. It would be equally challenging to envisage transforming the Façades of all the buildings in the municipality in a short period, but selected pilot constructions could represent a beginning in embarking on this path. These initiatives could encompass not only the Façades of buildings but also public spaces, monuments, and heritage preservation efforts.

In conclusion, the utilization of locally sourced limestone as a building material in the Finiq municipality holds the potential to not only provide practical benefits but also to foster a sense of local identity, promote cultural continuity, and contribute to the conservation and enhancement of the region's unique historical and geological heritage. It may require a phased approach, starting with pilot projects and gradually expanding to encompass a broader range of architectural endeavors.

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