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## Usage of stone materials in natural and human environment, case study in Epirus, Greece

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### Abstract

Stone in the past decades has been the most widely used building material, highly tied to the natural environment. The stone walls, dams, warehouses, farmhouses, paving, etc., are remarkable stone constructions and functional creations. Stone as building material was originating from rocks in the near territory, resulting an absolute harmony with the natural environment. From a hydrological and hydrostatical point of view, many of the protective type stone structures (terraces, dams) had gaps in their main body for passage of the water, significantly reducing the hydrostatic loads and increasing their stability. Finally, stone constructions as terraces, gutters, benches and walls protect agricultural lands and increase the soil moisture making them productive. In the present paper the agrotechnical, constructional and hydrologic characteristics of stone structures in Epirus Greece are presented.

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### 1. Introduction

Since the development of the first organized societies the need to build houses and other structures such as theatres, divinations, temples, walls etc., to protect against natural phenomena and to conservation of high slope terraces, which are easily effected by erosion phenomena, lead us to find building materials suitable for the construction of such structures. The structural material, which has and continues to have a dominant position in these constructions, was the stone, and the stone with binder of natural materials (lime, clay, mud, wood etc). In areas with an abundance of suitable stone materials the prevalence in the construction was absolute. Typical cases of absolute prevalence of stone material in Greece are Zagoria (Arapoglou, 1981) and Mani (Fig. 1).

Stone against the other natural materials (wood, clay, mud, grass, branches, ice, etc.) has excellent mechanical properties such as strength in time, offering maximum security against external threats. Also, very important is the usage in many signages and the ability to create multi-functional indoor spaces. Structures such as the Pyramids, the Great Wall, the Cyclopean Walls, Castles, theaters, churches etc. are impressive stone structures. Often stone

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construction, in order to avoid extreme weather conditions, acquire special architectural form using natural cut stone in very large pieces (> 2,00m). Typical such cases are the Mitata of Crete which are circular buildings for the residence of the shepherds in the mountainous regions of Psiloreitis (Fig. 2).

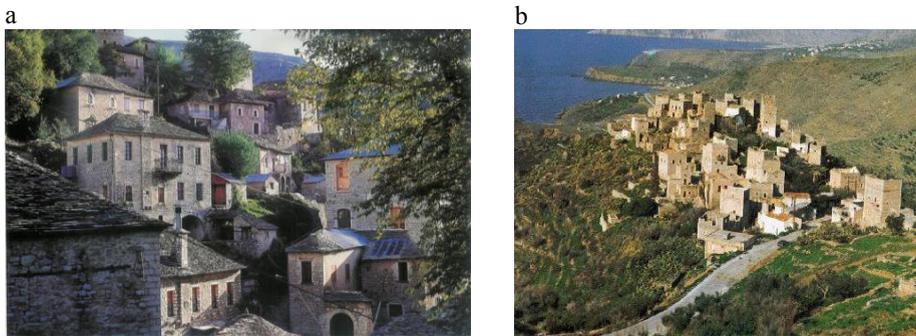


Fig 1. (a) View of Sirako in Tzoumerka, Greece; (a). View of Mani, Greece

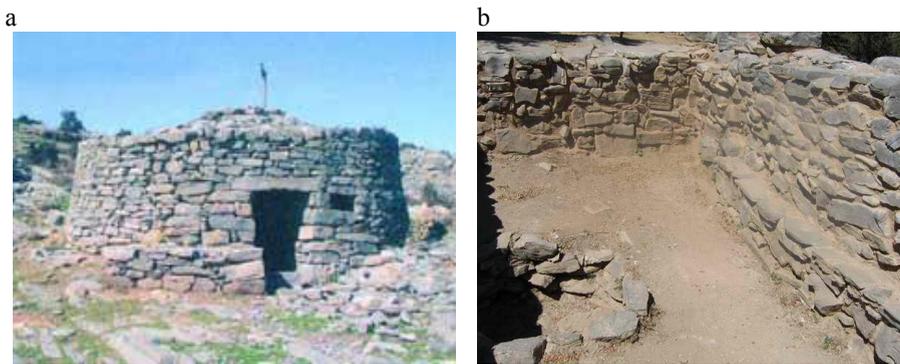


Fig 2. View of Mitata in Crete; (a). External view; (b). Internal view

Stone was used in the construction of benches and terraces of the ancient Greeks (Gkanatsios et. al., 2012). Terraces were stone walls for prevailing erosion in areas with high slopes. In Aegean islands and in mountainous Greece retention of land and soil moisture was a matter of survival (Vernicos et al., 2002). The maintenance of life and culture in these regions were closely linked to the construction of protective stone walls (Zahariades, 2004). Although terraces aimed at soil protection and increase of humidity they also created impressive aesthetic modules perfectly harmonised with its surroundings, making them essential cultural elements in the construction areas. The harmony of the local stone material with green crops and soil colors created spectacular formations. The use of stone as a building material covering other equally important human needs, such as building bridges and dams and paving of trails and roads (Koronaiois and Sargentis, 2005). Before the discovery of all concrete bridges, dams and roads constructed using natural stone with or without binder. The beautiful stone arch bridges of our country and stone made dams (Fig. 3), etc., were and are excellent structures in the natural environment giving a new aesthetic view, which is not contrary to the natural landscape but adds a charming touch (Figure 4). For this reason, the beautiful stone arch bridges of our country apart from basic nodes and channels of trade, transport and communication of peoples and cultures, were an exquisite elements of our cultural heritage.

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