

V. THE STONE PRODUCTION IN MEDIEVAL YEGHEGIS

Raw Materials, Products, and Toolmarks

Abstract / Exploring the archaeology of stone production in Yeghegis between the ninth and fourteenth centuries, this chapter investigates the operational chain (*chaîne opératoire*) of stone artifact production, from quarrying to construction. The study adopts a dual approach: analyzing the results of building stratigraphy and examining potential quarrying sites – an aspect previously unexplored in this region. As such, it falls within the archaeology-of-production framework, particularly concerning pre-industrial stonework, and is conducted as part of a Light Archaeology project on medieval settlements in Vayots' Dzor. By documenting basalt quarrying sites and tracing the transport and working of stone, this research sheds light on the labor force involved, the scale of production, and the socioeconomic dynamics of medieval stonework. This methodology enhances understanding of the demand for cut stone, the logistics of its transport, and the organization of specialized artisans. The result is deeper historical insight into the construction processes and the society that exploited and sustained them.

Keywords / archaeology of production, medieval buildings, operational chain (*chaîne opératoire*), quarries, stone traces, toolmarks

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INTRODUCTION

The oldest known epigraph extant in Yeghegis, placed at the southern entrance of the so-called Old Church,¹ states that in 851 “king T’agen (?) gave from Tsaghkots’ for the ashlar of this church,” thus attesting to the transport of stone ashlar for the construction of that building.² Nowadays, anyone wandering around the village’s rugged terrain and its environs may be struck by the conspicuous presence of traces attesting to the diverse uses of stone as a material during the long Middle Ages, especially during the ninth to fourteenth centuries – the main period of consideration in this paper. Evidence for the use of stone is mostly preserved in the form of traces left in local basalt, which has many shades, from reddish to darker grey.³ These basalt stones were reified in buildings (ashlars and architectural elements), in *khach’k’ars*, in sarcophagi or tomb slabs, and in epigraphs.

The purpose of this chapter is to provide an archaeological interpretation of the production cycles of stone artefacts as they can be examined today in the Yeghegis area. I do so both by looking at the features of the preserved products and, when possible, at the extraction sites of raw materials. This latter type of analysis has hitherto never been carried out for this area and constitutes the most original contribution of this research. This double approach allows us to closely follow the different stages of the operational chain leading to the production of various (stone) objects. Methodologically, this work falls within the theoretical framework of the archaeology of production, particularly for the period predating the Industrial Revolution. In addition, this research was conducted within the framework of a Light Archaeology project aimed at defining the characteristics of medieval settlements in Vayots’ Dzor, at the crossroads of the so-called medieval Silk Roads network.⁴

Archaeology of production provides an opportunity to deal with multiple topics related both to those who were skilled in the production of artefacts, starting with the characteristics of the different raw materials used, and to those who, with or without the help of intermediaries for purchasing, used them. In such a broad field of research, stone products play a very important role, especially in the case of the working of building stone, or, still better, of cutting stone.⁵

* Field research for this project was carried out with the support of the Italian Ministry of Foreign Affairs and International Co-operation (MAECI) for the project “The Making of the Silk Roads in Vayots’ Dzor,” as well as a European Research Council (ERC) Consolidator Grant Jews and Christians in the East: Strategies of Interaction between the Mediterranean and the Indian Ocean, (grant agreement no 647467). The article was written and published with the support of the ERC Consolidator Grant Armenia Entangled: Connectivity and Cultural Encounters in Medieval Eurasia 9th–14th Centuries” (ArmEn) (Grant number 865067). Both ERC projects were funded under the European Union’s Horizon 2020 research and innovation program.

1 For the presentation and stratigraphic reading of the so-called Old Church, see chapter 7 in this volume by Nucciotti and Cheli, pp. XY–XY.

2 For a transcription and translation of this epigraph, see Hamlet Petrosyan, Zarouhi Pogossian, “Armenian Inscriptions of Yegheghis and around”, inscription vi.1, in chapter 11 in this volume.

3 Field research allowed us to identify by autopsy the lithotype used, as well as the quarrying areas. The importance of the choice of the lithotype was summarized as follows by Tiziano Mannoni: “*La natura petrografica degli elementi litici è utile perché determina in buona parte le forme grezze (facce parallele degli stratiformi e degli scistositi), la tecnica di lavorazione più facile e meno costosa (durezza, tenacità, sfaldabilità), la messa in opera più durevole (orientazione dei ‘versi’), oltre ai valori estetici (colore, effetti di superficie, espressione di robustezza).*” See Tiziano Mannoni, “Archeologia della produzione architettonica. Le tecniche costruttive”, *Arqueologia de la Arquitectura*, 4 (2005), pp. 11–19, sp. p. 17.

4 Proposing landscape projects to answer purely historical questions through the stratigraphic analysis of buildings, sometimes with the aid of some stratigraphic excavation at a specific sample site, has long characterized the work of the Florentine Chair of Medieval Archaeology. For a definition of “Light Archaeology” in relation to our work in Vayots’ Dzor, see Michele Nucciotti, Elisa Pruno, “On the Archaeology of the Silk Roads Landscapes in Vayots’ Dzor (Armenia) in 13th–14th Centuries: New Methodological Approaches”, *Facta*, 15 (2021), pp. 75–96, sp. pp. 79–80. The interpretation of the territory on which Yegheghis lies as a road-area connected to the Silk Road trajectories was defined in Michele Nucciotti, Hamlet Petrosyan *et al.*, “The Making of the Silk Road in Armenia (7th–14th): Vayots Dzor and Arates Monastery”, in *vii Congresso Nazionale di Archeologia Medievale*, (Lecce, 9–12 settembre 2015), Paul Arthur, Marco Leo Imperiale eds, Florence 2015, pp. 493–498; Michele Nucciotti, Elisa Pruno, “L’Armenia Orientale, l’invasione Mongola e la via della Seta”, in *Intervento presentato al convegno vi Ciclo di Studi Medievali tenutosi*, (Firenze, 8–9 giugno 2020), Lesmo 2020, pp. 287–292, and again in Nucciotti/Pruno, “On the Archaeology” (n. 4).

5 In this case, the definition of cut stone emphasizes the builders’ need to have quarried stone and not merely gathered stone (as in the case of river pebbles, for example) to put in place. A possible definition that can also be used in this contribution is the following: “*intendre par ‘pierres de taille’ les roches spécialement façonnées pour occuper une place précise dans la construction, sous la forme de parements ou d’éléments architectoniques, décorés ou non*”. See Jean-Claude Bessac, “Observations sur la construction monumentale dans le nord-ouest de la République d’Arménie”, *Syria. Archéologie, Art et Histoire*, 88 (2011), pp. 379–415, sp. p. 381.

In order to identify the possible production cycles of the building artefacts that have been preserved and stratigraphically studied, the chapter has another major goal: the survey, documentation, and analysis of several basalt quarrying sites within areas that could potentially be used for this purpose, as currently recognizable in the surroundings of Yeghegis.⁶ Indeed, I analyze the need and demand for construction stone, as highlighted by archaeological readings conducted on the main buildings still present within the village, and suggest possible areas of its supply. In this “journey” from the quarry to the buildings, I attempt to “photograph” the work of various types of laborers based on the material traces of their work.

This chapter, therefore, is concerned with the archaeology of production in a full sense, and as applied to the field of the stratigraphic study of historic buildings according to a definition adopted in various studies produced in Europe and, particularly, in Italy, during the last few decades.⁷ The peculiar approach adopted in this paper, which carries out research on building production by focusing on the possible quarrying sites of the raw material and takes into account the requirements and characteristics of the finished buildings, allows one to hypothesize about the quantity of cut stone needed in order to meet the demand during different stages of construction, with their differing intensity (and thus different levels of demand for cut stone). This enables us to form an idea of the scale of activities carried out in a given period by workers active in the area, albeit in broad terms. At the same time, one can try to shed light on distances between extraction sites and the places of installation (thus also hypothesizing which kind of vehicle might have been necessary), the types of specialized workers who were in charge of the various production phases, and also try to define their evolution or involution over time.⁸ Indeed, as Jean-Claude Bessac has stated:

*“L’étude des constructions, notamment par l’intermédiaire des techniques et des traces d’outils, doit conduire aux hommes qui les ont produites: carriers, bardeurs, transporteurs, tailleurs de pierre, sculpteurs, poseurs, et, au-delà, à la société dans laquelle ils vivaient.”*⁹

ARCHAEOLOGICAL SOURCES AND THEIR INTERPRETATION

The motivation to initiate research on the use of stone as a building material in medieval construction in well-defined historical area, through the examination of the quarrying phase of the raw material, arose from the awareness of the peculiarity of this moment in the production cycle from which many of the subsequent building operations and many of the specific characteristics of the various building products inevitably derive.¹⁰ The supply phase of building stone involves a series of interventions on the material that, at least partially, reverberate in the finished work and are therefore also potentially investigable through the analysis of artifacts.

- 6 Defining a potential area of extraction and supply of stone material for building is a research activity on a territorial basis that, by systematizing all available sources, aims to circumscribe areas of a few tens of kilometers, around the main sites, within which to try and verify the presence of quarries that were actually exploited. For an example of such research, conducted by the University of Florence working group, see Elisa Pruno, Michele Nucciotti, Daniela Peloso, “Modelli numerici per l’interpretazione dei processi produttivi dell’edilizia medievale amiatina: la cava di pietra di Gravilona (Monte Amiata in Toscana)”, in *Laser scanner e gps. Paesaggi archeologici e tecnologie digitali*, Stefano Campana, Riccardo Francovich eds, Florence 2006, pp. 117–142; Elisa Pruno, *Cave e petriere nell’Amiata occidentale. Lo sfruttamento delle risorse lapidee per la produzione edilizia medievale*, Florence 2018.
- 7 For a definition of historical building archaeology and its characteristics, see Nucciotti/Pruno, “On the archaeology” (n. 4).
- 8 See an example of research aimed at investigating the exploitation of stone resources used for the construction of buildings studied stratigraphically in Pruno, *Cave e petriere* (n. 6). For the need to address similar issues in Armenia: “*En l’absence d’études de carrières médiévales et d’indices spécifiques observés sur les pierres de taille en œuvre, il est impossible actuellement d’aborder efficacement ce thème. Cette carence montre la nécessité de prospecter les zones d’affleurements situées à proximité des monuments.*” See Bessac, “Observations” (n. 5), p. 397.
- 9 “The study of constructions – particularly through the analysis of building techniques and tool marks – must ultimately lead us to the individuals who produced them: quarrymen, haulers, transporters, stonecutters, sculptors, masons, and, beyond them, to the society in which they lived.” See Jean-Claude Bessac, “Pierres de taille : archéologie et technique”, in *La construction. Les matériaux durs : pierre et terre cuite*, Alain Ferdière ed., Paris 2020, p. 8.
- 10 This contribution will use the definitions of “raw material” and “material” as described in Tiziano Mannoni, Enrico Giannichedda, *Archeologia della produzione*, Torino 1996, pp. 197–201. Thus, “raw material” is understood as, for example, the stone present in a quarry, whereas “material” is the stone already worked and waiting to be used.

Each study of a buildings' stratigraphic analysis enables us to emphasize certain choices adopted by builders, such as the use of collected, re-used, or specially quarried material for the various buildings or finished stone products, as long as such a study is carried out with due attention to specific aspects of activities of various groups of workers operating in a given area. Each of these options indicates a particular way of organizing the workflow, highlighting economic and technical choices that could also be very different. From the foregoing, it is clear how, in the final analysis, one may try to indicate the connection between the choices made by craftsmen and the needs of the client, who decided to rely on one group of craftsmen to the exclusion of others. The stratigraphic investigation of buildings offers an opportunity to place the various interventions that occurred in the realization of a building work in a chronological sequence. As a result, this enables us to chronologically and qualitatively define, at least in some cases, the different ways in which raw material was acquired within the same temporal sequence. This allows us to attempt to historically characterize the distinction between construction operations that benefited from the quarry supply-phase of the stone material vs construction operations without the quarry supply-phase of the stone material (these latter are more affordable and less technologically complex). Investigations that shed light on the presence and diffusion of quarrying sites as well as their characteristics have rarely, if ever, been carried out, and their potential for producing innovative results is undeniable, given the untapped evidence they can yield. This approach also offers the chance to reflect on exploitation methods and management of raw material by different socio-political actors and within the realities of the area under investigation. Needless to say, we are dealing with the exploitation of raw material of enormous interest, both from an economic point of view and in terms of symbolic aspects linked to the expression of power.

As often happens in studies within the field of archaeology of production, our research starts from the analysis of the finished product.¹¹ This means that we have to begin by considering how much raw material was used in different building phases identified stratigraphically in the Yeghegis area. I have taken

into consideration what has been stratigraphically analyzed regarding the Zorats' complex (comprising the church building, the monastic annexes and the walls), the Cupola Church and the Old Church, in order to define the requirements for squared and flattened cut stone in each construction stage, i.e., the types that were most likely to have been quarried and that underwent the most time-consuming processing (and therefore also require the greatest economic investment). Cut stone is still the main material used in the so-called Örbēlean and Jewish cemeteries, even though here it was not employed for constructing buildings but rather for making burial stones.¹² Lastly, near the Jewish cemetery, along the banks of the Yeghegis River, there is another building complex to be analyzed here that comes to contribute to the overall picture of the need to produce quarrying stone, to be used variously and with different levels of processing, at least in two historically attested moments, albeit with inevitable gaps and uncertainties:

- 11 One case in point is ceramics. In fact, it is possible to outline the production processes (from the definition of the raw materials, such as clay, glazes, pigments, with the location of the different areas of origin, to the technologies used, such as, for example, turning) by studying the remains of artifacts found in excavations. This possibility of investigating the production processes starting from the finished products, which is based on the recognizability of the different characteristics of the cycles (use of raw materials, their processing, tools used) is extremely useful also because it allows us to find all the data necessary for reconstructing the production process within an archaeological investigation, starting from the places where the raw materials were found to the investigation of the workshops or the places where the necessary processing took place.
- 12 Regarding the designation of the so-called "Örbēlean cemetery," see the discussion in chapter 11 in this volume, with further bibliography. The earliest studies on the Jewish cemetery (and, therefore, on the presence of a Jewish community in Yeghegis, from at least the thirteenth through the fourteenth century) are due to Michael E. Stone and David Amit. See Michael E. Stone, David Amit, "Report on the Survey of a Medieval Jewish Cemetery in Eghegis, Vayots' Dzor Region, Armenia", *Journal of Jewish Studies*, 53 (2002), pp. 66–106; *idem*, "The Second and Third Seasons of Research at the Medieval Jewish Cemetery in Eghegis, Vayots' Dzor Region, Armenia", *Journal of Jewish Studies*, 57/1 (2006), pp. 99–135, with a resumption by our working group in 2018. See some considerations in Michele Nucciotti, "Light Archeology at Yeghegis Jewish Cemetery. Analysis and Interpretation", in *Material Encounters between Jews and Christians: From the Silk and Spice Routes to the Highlands of Ethiopia*, Bar Kribus, Zaroui Pogossian, Alexandra Cuffel eds, York 2024, pp. 45–58; Nucciotti/Pruno, "On the archaeology" (n. 4).

- Ninth century (in particular, the square ashlar laid in the Old Church and the associated epigraphic evidence).
- Thirteenth–fourteenth century (the squared and flattened ashlar phases of the Zorats' and Cupola Churches); the outbuildings in the Zorats' Monastery (buildings below the church); the Jewish cemetery; the use of worked stone material for the Ōrbēlean and Jewish cemeteries.

There are also a third and a fourth phase, which can be framed through archaeological research, but whose precise chronology is less easy to define:

- The first (third in our sequence here) is to be placed before the twelfth century. Some of the elements of the wall that delimit the area of the church and monastery of Zorats' are attributed to this period.
- The second (or fourth) refers to some outbuildings of the twelfth century, which were excavated a few years prior to our research. Traces of materials from this period are known from the excavations conducted by Husik Melkonyan.

Having identified the chronological phases of cut stone artefacts in this way, it is necessary to go into greater detail, trying to hypothesize the quantities of raw material required for the different buildings within the two moments of greatest intensity of the presence of ashlar, currently still visible.

We should first consider the period when there is an archaeologically attested kind of building boom in Yeghegis, i.e., the chronological span between the thirteenth and fourteenth centuries. As we have seen, all the material used was local basalt, the specific weight of which is 2990 kilograms per cubic meter. If we try to do some calculations, we find that for the period of the major construction phases of the Zorats' and Cupola Churches, about 260 tons (equivalent to 260.000 kilograms) of raw material had to be produced in the case of the former, and about 302 tons (equivalent to 302.000 kilograms) for the latter. If we then consider that

"[...] un mulo non porta carichi superiori a 150 chili (due pietre di cm 20×20×70); un paio di buoi può tirare un carro con un carico 800–1000 chili (un blocco di

*pietra di cm 100 × 100 × 35) su strade con pendenze non superiori al 3% [...]"*¹³

We can easily grasp the size of the investment required for the construction of these two buildings, which, as we have already seen, constitute only a part of the panorama of stone artefacts in Yeghegis at this stage. In addition (and this is no small thing), these quantifications, likely underestimated here, help us also to imagine the movement created by the need to transport the raw material from the quarry sites to the site of building. This was done either by carts if the roads allowed, or by pack animals. The quantification above permits us to imagine the traffic of men and workers who had to transport the material. Another aspect to be emphasized is that these large quantities of raw material became squared ashlar, a complex task that required many hours of work by stonecutters.¹⁴ Once again, it is necessary to emphasize the concern that the raw material be of high quality, that the distance to the quarry not be excessive, and that the material waste not lead to unsustainable quantities.

At this juncture, we must pose the question regarding the actual existence of sites for extracting local basalt from which all the artefacts considered in the present study were made. The work conducted by Amit and Stone on the Jewish cemetery of Yeghegis provides a useful tool for analyzing the local geology, from which the presence of two areas of outcrops of usable material emerges.¹⁵ During that fieldwork, a number of rock samples were taken (from the Jewish cemetery, the Ōrbēlean cemetery, and the Zorats' Church) and analyzed. The results

13 "[...] a mule cannot carry loads exceeding 150 kilograms (two stones measuring 20 × 20 × 70 centimeters each); a pair of oxen can pull a cart loaded with 800–1000 kilograms (a stone block measuring 100 × 100 × 35 centimeter) along roads with gradients not exceeding 3% [...]" See Tiziano Mannoni, "Premessa", in *Archeologia dei materiali da costruzione*, Aurora Cagnana ed., Mantova 2000, pp. 9–15, sp. p. 13.

14 Here again, we can refer to the research of Tiziano Mannoni, who has indicated the time required by an experienced master (*magister*) for the production of a single squared and flattened ashlar (i.e., the type of workmanship carried out in the Zorats' and Cupola Churches phases that we have taken into consideration for this analysis) as approximately eight hours.

15 See the geological report by Sergei Karapetyan in Stone/David, "The Second and Third Seasons" (n. 12), pp. 117–118.

indicated that it was entirely plausible that the material from the cemeteries came from the possible quarrying areas that were identified.¹⁶

As far as the study of the supply areas was concerned, however, the situation appeared somewhat sketchy. Although the research team led by Amit and Stone had identified the local basalt deposits, it was still necessary to verify the presence of actual extraction traces where possible. Therefore, the University of Florence team conducted systematic and selective survey campaigns, specifically aimed at identifying possible extraction areas. The areas systematically investigated were centered on the settlement of Yeghegis, and the area around it within a three- to five-kilometer radius.¹⁷ Within this, a more intensive search was eventually carried out in a zone demarcated as a probable quarry area. In this probable quarry area, quarries belonging to two different types were identified [fig. 1]: wall quarries and so-called *petriere*.¹⁸ These are areas of more or less intensively quarried erratic boulders, widespread in very different territories, from central Italy to France and Spain, which have also been called “disseminated” quarries.¹⁹ In both cases, topographical reference units (UT sheets) were identified and recorded according to the practice of archaeological field documentation and in conformity with a light archaeological survey. The identified UTs correspond to an area of territorial continuity in which there are elements that can be archaeologically interpreted as productive sectors related to stone quarrying.

The second level of documentation was concerned with the functional areas (FA sheet), which, located within topographical units, are characterized by the presence of traces indicating groupings of quarry activities (e.g., waste materials). By examining the territory of Yeghegis in this way, it was possible to identify a large quarry area, which is still partly exploited today [no 2 in fig. 1] and a very large *petriere*, which, in fact, skirts the area of the church of Zorats’ and its annexes [no 1 in fig. 1].

THE PETRIERE OF YEGHEGIS

Jean-Claude Bessac, in one of his many studies dedicated to the extraction and working of stone, describes the exploitation of erratic blocks as follows:

“L’exploitation de blocs erratiques ... [est] la plus commune et probablement la plus ancienne des stratégies d’extraction extensives [et] consiste à tirer profit des éboulis naturels entassés en pied de falaise ou bien des blocs erratiques naturellement isolés du substrat.”²⁰

This quarry type is well-represented and visible in Yeghegis, even simply by walking through the streets of the village [fig. 2]. The research, however, concentrated in a comprehensive manner on the Zorats’ *petriera* [no 1 in fig. 1], due, in particular, to its greater completeness in terms of topographical extent, as well as the fact that it allows for more general considerations regarding the exploitation methods adopted and the possible uses of the raw material.

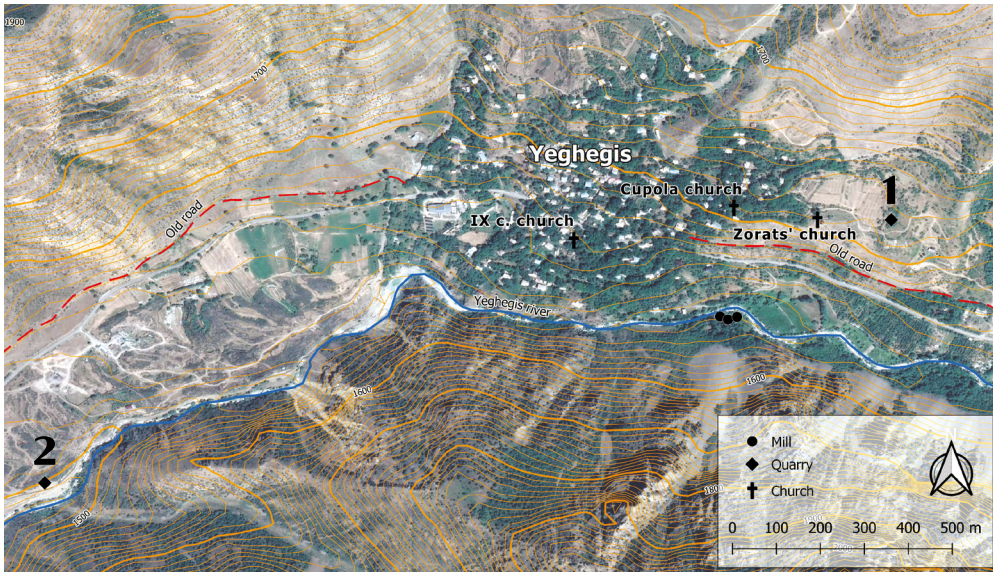
16 Karapetyan says: “The analyzed material was: a tombstone from the cemetery of Orbelian princes (the right side of the river near the village Eghegis, sample 4525, point 3); a tombstone from the Jewish cemetery (the left side of the river near the village Eghegis, sample 4529, point 4); a tombstone from the Jewish cemetery, taken out of the river and lying on the left bank (sample 4530, point 4); stones used in the masonry of the churches Zorats’, Gmbetawor (sample 4531). As a result of the assay, it may be concluded that all analyzed samples are basalt andesites and petrographically are identical with the rocks of the lava-stream on the crest of the right slope of the river southwest of the village Eghegis (sample 4533, point 1). Most probably these very lavas were used for the tombstones of the Jewish cemetery and that of Orbelian princes. A stone from the young stream: black porous basalt andesite (sample 4534, point 2) was used for one tombstone in the Jewish cemetery.” See Stone/David, “The Second and Third Seasons” (n. 12), p. 118.

17 For the definition of a probable quarry area, see Pruno, *Cave e petriere* (n. 6), p. 13.

18 Michele Nucciotti, “Le murature medievali di Santa Fiora (Monte Amiata - Toscana). Mensiocronologia delle murature in pietra: un caso di studio”, *Archeologia dell’Architettura*, 5 (2000), p. 78.

19 Pruno, *Cave e petriere* (n. 6), pp. 41–44.

20 “The exploitation of erratic blocks is the most common and probably the earliest among extensive extraction strategies. It consists in making use of natural rockfalls accumulated at the base of cliffs or of erratic blocks naturally detached from the bedrock.” See Jean-Claude Bessac, “L’extraction des pierres de taille et des roches marbrières dans l’Antiquité: les principales stratégies d’exploitation”, in *Marbres en Franche-Comté. Journées d’étude*, (Besançon, 10-12 juin 1999), Laurent Poupard, Annick Richard eds, Besançon 2003, pp. 21–34, sp. p. 25. Bessac also says that sometimes, depending on its initial volume, the natural block is simply squared on-site before being transported to the carving site. Despite its presumably prehistoric origins, this practice continued throughout Antiquity and even well beyond, as we can see here.



[fig. 1] Localization of two quarry areas in Yeghegis

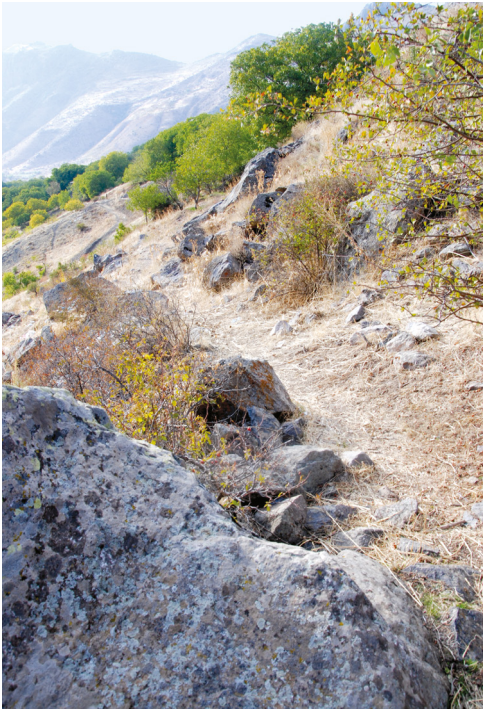
The definition of the parameters for understanding exploitation patterns is a pivotal step in the analysis of *petriere*, which are outcrops exploited with varying intensities for basalt block extraction. In fact, the traces of *petriere* quarrying are more difficult to identify than in wall quarries. With the exception of cases where wedges were used (which is not uncommon in the Zorats' *petriera*), it is quite complicated to identify extractive traces from those of natural erosion. This identification is, however, crucial for distinguishing between areas where the presence of signs of anthropic detachment is very intense and areas where these signs are fading, so as to define the extent of the site in question with a reasonable degree of accuracy. While it will be difficult to attempt to quantify the material extracted in a given period due to the aleatory nature of the size of the site itself, it will be of some interest to emphasize the economic and social organization of this type of exploitation.

It is now appropriate to describe in detail the Zorats' *petriera*. Its extension covers an area of approximately 150 by 200 meters, and it lies behind the building of the Zorats' Church with some ramifications along its northern side. This territory [fig. 3], which slopes from west to east, has been subdivided into five TUS, corresponding to topographically distinguishable areas, characterized by the presence of

blocks with anthropic detachment marks at different levels, still present *in situ*. The *petriera* is currently crossed by a path, bordered on both sides by blocks showing more or less intense signs of exploitation (given the topographical discontinuity, they have been divided into two separate TUs). To identify the distinguishing criteria between anthropogenic and natural detachments, the first clue, of course, is the presence of toolmarks, such as wedge marks [fig. 4]. In their absence (which could be caused by wear or even the detachment of parts of the rock where they were once present), the common identifying element, which must be observed, is the morphology of the block itself, which is obviously different, even in size, between those quarried and those not exploited. Thus, the morphological criterion associated with the presence or absence of toolmarks functions as the distinguishing feature when assuming the presence of boulders used to quarry stone. The criteria thus identified were assigned a reliability index in descending order: certain, probable, and possible. There are essentially three morphological types classified as follows:

TYPE 1

Stone residue with a tendency to be horizontal, the outcropping block is at an elevation close to



[fig. 2] Exploited erratic bloks

[fig. 3] *Petrieria* area in Zorats'





[fig. 4] Example of wedge marks

the ground level. The course of the internal surface may be horizontal or concave. The cut edge is clear with respect to the original inclination of the block walls [fig. 5].

TYPE 2

The stone residue is vertical with respect to the ground plane, and the contours of the cut are tentatively vertical [fig. 6].

TYPE 3

The residue has a rectangular appearance, with three surfaces left free by the removal of the basalt block [fig. 7].

Based on what has been said so far, the description of the distinct TUS in the Zorats' *petriera* continues below. The presence of detachment marks is common to all areas, with differences related to the concentration of quarried blocks and the presence of areas where they are sparse. Two of the five TUS are located at the sides of the path [fig. 4], while two others are outside the walled enclosure, along the slope descending from the western side of the church. Finally, the last TU, TU 5, is located just inside the wall, where blocks both with and without toolmarks (especially wedge marks) are present. The elements that identify all the TUS as quarry areas are clear: in fact, one can see blocks with morphology sometimes of TYPE 1, rarely of TYPE 2 and 3. The toolmarks all refer to pointed tools or wedges, the latter of which seem to have been used expertly and systematically. The traces left behind suggest the use of two different types of wedges, one more rounded and one more triangular. The sharpness of the traces suggests that the wedges used were made of metal rather than wood. On the other hand, the entire site is very large, and the dispersion of the erratic blocks is homogeneous. Thus, the exploitation of the material was certainly spatially extensive (for the temporal extent, see §3).

please add

It is worth noting the almost total absence of working waste, i.e., basalt flakes, at least on the present floor level, but the probable significance of this will be discussed later. A final noteworthy element is the presence of a block, only partially preserved, which may have been a stone tank. We will not enter here into an extended discussion of the possible functions of a water basin in areas associated with

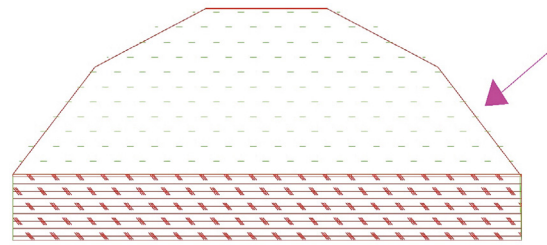
multiple forms of land use (such as quarrying and, at least today, animal grazing).²¹ Of course, it is well known that, at least for quarrying activities, the presence of water is a crucial element, for example, in the constant maintenance of metal tools. The stone tank in the *petriera* at Yeghegis may have been used for this purpose, at least during the period when the *petriera* was active.

At this point, the presence and characteristics of the wall quarry at Yeghegis should also be defined.

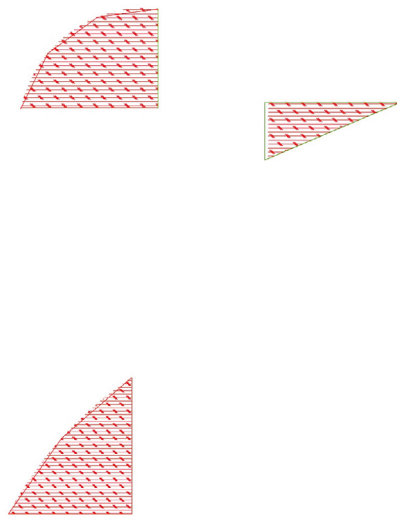
WALL QUARRIES IN THE PERI-URBAN AREA OF YEGHEGIS

Within the area around the contemporary site of Yeghegis, close to still active quarry fronts [fig. 8], there is one front [fig. 9] whose morphology may suggest its use in pre-industrial times. The first step in the survey was a visit to a quarrying factory producing processed and semi-processed stone products. This is an industrial company whose business activities bear witness to the continued importance of basalt exploitation in this area of Vayots' Dzor. The features of this company's functions can contribute to our understanding of quarrying activities, albeit with industrial logic and tools.²²

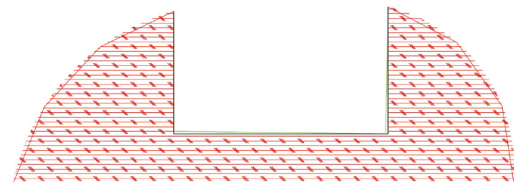
It is worthwhile to point out the presence of stone material at different degrees of processing (from raw blocks to semi-processed ones, to some fully worked blocks), as well as the presence of waste and processing residues. As a result of this visit, based on oral accounts provided by the owners of the contemporary structure, it was possible to inspect the oldest quarry front, which until now was unknown. Its location corresponds to 39°51'52.7" N 45°20'41.7" E, and the quarry front is currently visible in its entirety from the quarry yard.²³ The area is quite large, about 200 meters by 30 meters high, and shows cut marks on the vertical rock face, in which an ancient quarry front can be recognized. At its base, there



[fig. 5] Type 1 of morphological trace of exploitation



[fig. 6] Type 2 of morphological trace of exploitation



[fig. 7] Type 3 of morphological trace of exploitation

²¹ For a discussion of similar cases, see Pruno, *Cave e petriere* (n. 6).

²² The structure would allow a useful analysis for the purposes of setting up industrial archaeology research, to be closely linked to this research on the archaeology of the production of stone elements, in order to develop it diachronically, encompassing the crucial transition between the pre-industrial and post-industrial eras.

²³ A quarry yard is defined as the space below the main front, where many of the main mining activities were carried out.



[fig. 8] Contemporary quarry front

[fig. 9] Ancient quarry front



are accumulations of blocks of varying sizes, with various traces of detachment, as well as small to medium-sized chips. In the quarry front, visible at a not insignificant distance, there are numerous traces of detachment of medium-large blocks, with a vertical direction, flanked by portions of the quarry wall showing small and non-compact material, probably points where the basalt vein is not of the best quality.

In general, it can be said that the tool signs vary in intensity and arrangement within the front, indicating, in all likelihood, a lack of systematic methods in the quarry operations. Due to the viewing distance, it was not possible to determine the exact patterns of presence and distribution of toolmarks used to detach the stone blocks. Naturally detached blocks and small stone pieces were found and examined in the quarry yard, as well as semi-processed pieces, residues, flakes, and quarried blocks. These remains decrease in intensity as one moves further from the quarry front. In the quarry yard and in the areas in front of it, one can observe multiple elevation changes, perhaps due to the presence of accumulations of lithic material, which has been covered and obliterated by the growth of humus over time. In general terms, the terrain slopes down from the base of the front towards the present-day path which borders it.

Overall, therefore, it was possible to verify the presence of many different elements that confirm the past existence of a basalt quarry.

Given the available evidence from the two types of stone quarries, it is necessary to move beyond identifying gestures associated with the use of stone for producing objects – such as buildings, sarcophagi, and architectural elements – and begin recognizing these as deliberate actions carried out by specific individuals, within a defined historical and social context: that of medieval Yeghegis. To paraphrase Leroi-Gourhan, we must shift from general technical tendencies to individual technical facts.²⁴

FROM DATA TO AN INTERPRETATIVE SUGGESTION: STONE QUARRYING IN YEGHEGIS IN THE MIDDLE AGES

The data presented so far highlight two basalt quarrying areas of different types, within an area extending up to five kilometers from the present-day

village of Yeghegis: a *petriera*, i.e., an area for the exploitation of erratic rocks, and a more “classic” wall quarry. The elements that have been considered for their study are essentially the morphologies and the traces left by the tools used to extract the stone. From a historical-archaeological point of view, though, it is now necessary to ask some specific questions about the collected data. Specifically, we must find out what chronology can be attributed to their use and which production needs they were intended to meet.

The first point, the chronological one, is undoubtedly the most difficult to address, especially in the absence of written sources, on the one hand, and stratigraphic data, on the other hand. The two sites appear as “still-images” that do not correspond to a real situation at any point in their activity phases, a condition archaeologists commonly face.²⁵ In fact, signs and morphologies that could belong to different chronological moments are observed and discretized, without having the real possibility of distinguishing them, even according to criteria of relative chronology.²⁶ It is possible, however, to draw inductive conclusions, taking into account some clearly visible elements in both quarries: the morphology of the blocks still *in situ* and the traces of tools. In the case of the Zorats’ *petriera*, the morphology of the blocks that have been quarried is often of TYPE 1, thus indicating an intentional and precise exploitation. The edges are almost never sharp, which might suggest that a lot of time has passed since they were quarried. Considering also that the only toolmarks visible are those left by quarry wedges or pick-axe tips, it may be plausible to propose a chronology

24 André Leroi-Gourhan, *Evoluzioni e tecniche. I. L'uomo e la materia*, Milan 1993.

25 Jean-Claude Bessac emphasizes in many works that the unearthed remains bear witness to the maximum extension of the quarry in both plan and depth, which does not correspond to any topographic reality at a given moment of exploitation: indeed, the different occupation surfaces and the quarry walls were destroyed or covered as the exploitation progressed. The only realistic state that could ultimately be observed is that of the quarry's abandonment.

26 Unfortunately, in fact, the evidence from the quarries is such that the different quarrying phases effectively cancel out the previous ones, leaving it difficult to define physical-stratigraphic relationships that can be dated relatively, let alone absolutely. For this reason, stratigraphic excavations could lead to clarifying the situation and are therefore highly desirable (see § ...).

please add

corresponding to the pre-industrial period (since, above all, no tools compatible with the later phase are evident). The same applies to the wall quarry. In the latter case, moreover, the morphology of the wall cuts and their size suggest that the cuts are neither modern nor ancient [figs 8–9], at least in the absence of studies in Armenian territory that might contradict these hypotheses. Bessac, in fact, already complained several years ago:

*“D’un autre côté, la question des carrières n’a été qu’effleurée et nécessiterait des prospections dans les environs du monument. Les enquêtes sur les parallèles techniques potentiels de la région sont nettement insuffisantes.”*²⁷

Therefore, typological comparisons are limited to what is known from the Mediterranean basin and the Middle East.²⁸

The second question concerns the community’s demand for building stone. Once this need is understood, it will be possible both to indicate the periods when the community needed building stone and to identify the times when the production cycle was activated and, therefore, to analyze precisely the characteristics of the exploitation adopted. Based on the research of the University of Florence team on the archaeology of medieval buildings, it is possible to identify four periods related to the use of stone, particularly local stone, i.e., basalt. The first, much more modest in quantity, dates back to the ninth century, while the last one, which spans a greater chronological range and is represented by more elements, also different in type, falls between the thirteenth and fourteenth centuries.²⁹ Within these two chronological *termini* (the ninth and fourteenth centuries), there are two other moments of great interest as far as the stone production cycle is concerned. They are, namely, the period just before the twelfth century, when some of the elements of the walls delimiting the area of the church and monastery of Zorats’ may have been built, and the period from the twelfth century onward, when annex buildings to the same monastery were constructed.

By integrating the relevant data on products (churches, civil buildings, city walls, cemetery stones) and on quarries, the following reasoning can be proposed: considering that all elements visible today were made of basalt, it must be assumed that two

quarry areas alone were probably not enough for the entire period spanning the ninth to the fourteenth century. However, as mentioned above, the entire present-day village of Yeghegis is interspersed with erratic blocks that have been partially or extensively exploited, and thus, plausibly, used over the course of time, while, as far as the wall quarries are concerned, the presence of the present-day company in the vicinity of the pre-industrial quarry may in fact have gradually eliminated traces of earlier quarrying.

The valuable ninth-century attestation in the small Old Church offers a very interesting clue, thanks to its epigraph which informs of King T’agen’s (?) donation of ashlar from Tsaghkots’. Given the vagueness of the topographical indication and the fact that all the construction phases of the church were made of basalt, one may ask whether some ashlar – particularly the squared ones – originated from quarrying areas not located in the immediate vicinity of the construction site. Unfortunately, the reasons behind such a choice remain unclear. Nor, on the basis of these elements alone, is it possible to exclude the presence of quarries in this area in the ninth century. What is certain is that there was a donation of ashlar by T’agen (thus also denoting a certain value of the gift). We can thus state that there was a constant need for stone material from the twelfth to the fourteenth century, with a diversification of products in particular between the thirteenth and fourteenth centuries. Their use was diverse, ranging from cut ashlar to rough-hewn or only split ones, as well as stone elements for making tombstones.³⁰ This allows us to hypothesize a rather

27 “On the other hand, the question of the quarries has only been superficially addressed and would require further field surveys in the vicinity of the monument. Investigations into potential technical parallels within the region remain markedly insufficient.” See Jean-Claude Bessac, “Observations sur la construction de la basilique d’Ezerouk en république d’Arménie”, *Syria*, 89 (2012), pp. 331–336.

28 Elisa Pruno, “Modifying Landscape: Quarries and Infrastructures in the Middle Age Mediterranean Area”, in *Cracow Landscape Monographs 2*, Piotr Kołodziejczyk, Beata Kwiatkowska-Kopka eds, Krakow 2016, pp. 123–133; Pruno, *Cave e petriere* (n. 6), and bibliography therein.

29 The only currently known building dated to the ninth century is the so-called Old Church, with the relevant epigraphic evidence (§...). In the last phase (twelfth and thirteenth centuries), much more stone production is identified, such as the squared and flattened ashlar of the churches of Zorats’ and the Cupola Church, the buildings connected to the monastery of Zorats’ and near the Jewish cemetery, as well as the stone material in the Arbelaez and Jewish cemetery.

30 The production of *khach’k’ars* is deliberately excluded from this research, as their study requires a range of skills that go beyond the competencies of the present writer.

please add

extensive quarrying activity. In periods of intense building boom, the coexistence of wall and *petriere* quarries in the area may have been most useful: the main construction phases of the church of Zorats' and the Cupola Church required square, flattened, and dimensionally homogeneous ashlar, elements that denote a clear control of the entire production cycle, from the quarrying phase onwards.

This type of demand is usually met through the exploitation of wall quarries, whose productivity is more predictable once the quality of the raw material has been verified. Moreover, the construction of these two buildings certainly relied on specific craftsmen's skills. This is further confirmed by the presence of two lapidary signs on the Cupola Church, which are the only ones attested among all the buildings analyzed in Yeghegis. In the pre-twelfth-century and twelfth-century phases, ashlar of varying sizes, either rough-hewn or simply split, were used for the walls of the Zorats' monastery complex and the buildings within it. What does this evidence suggest about quarrying-stage activity? These are blocks that could be extracted with relative ease in a *petriera*, as they are assembled in different sizes and do not need to be processed until they are squared. It is plausible that at least for part of these constructions the *petriera* present right around the church of Zorats' was used, guaranteeing, among other things, very low to no expenses for transportation. This factor is of considerable importance in the overall construction costs.

The production of tombstones around the Zorats' Church is excluded from this analysis, since neither of the two quarries examined indicates that specific blocks were quarried for the production of grave-stones. Only one semi-finished artifact has been identified in the Zorats' *petriera*. Therefore, having identified only a semi-finished artefact leads us to question where the rest of the production took place: perhaps in specific workshops? It is possible to hypothesize that in the production of tombstones in Yeghegis, both in the Christian and Jewish communities, distinct operational phases took place in different locations. The first phase, common to both communities, could also have been carried out at the *petriera*, while the second phase, which mainly involved the creation of the epigraphic part, was likely done in specific workshops, different for

the two communities, or even directly on-site (in the cemetery, that is).³¹

So, what conclusions regarding quarries can be drawn from the elements described so far? The survey carried out within a radius of three–five kilometers from the modern village of Yeghegis indicates that at least two types of basalt quarrying sites existed here in the pre-industrial period. Among these, the best known is the wall quarry. The other is a *petriera*, a term that defines the widespread exploitation of erratic rocks. To this end, the wall quarry in the peri-urban area of the village, currently located very close to a still functioning stone exploitation area, and the *petriera* located around the Zorats' complex were examined. Both revealed morphologies and toolmarks that can be traced to their exploitation in the medieval period rather than contemporary use. As is conventional practice in research on the archaeology of production, I then explored the medieval basalt production evidence present in the village already studied stratigraphically by the University of Florence research team (included in this volume and elsewhere). From this examination, a number of specific time periods were identified when there was a high demand for building material in the area, both for buildings and for burials. The period of greatest demand was between the thirteenth and fourteenth centuries. Prior to this, i.e., before and during the twelfth century, there was a need for rough-hewn or simply split blocks, for which a much smaller investment was required both in terms of economic costs and processing time.³² The material could be acquired from the *petrieras*, which implies less organizational effort, even if this process was certainly less predictable and less intensively exploitable. It is therefore possible to place the two quarries in and around Yeghegis within a mixed and complex production system, which distinguished between material to be squared and flattened, probably extracted from wall quarries, and material that could vary in size and processing, which could be extracted from erratic blocks, more or less close to the place where the final product (buildings, gravestones, etc.) would be standing or placed.

31 Nucciotti/Pruno, "On the Archaeology" (n. 4).

32 It should be recalled that according to some scholars – in particular, Cagnana, "Archeologia dei materiali" (n. 12), p. 62 – a single levelled and squared ashlar required an average of about eight hours of work by a skilled master.

CONCLUSIONS AND NEW RESEARCH QUESTIONS

The aim of this research was to try to define the historical characteristics of a production cycle, in this case, the production of building stones, within a specific territory and period. Based on this, a more general goal was to contribute to our understanding of a given society more broadly by posing and hopefully answering such questions as: who produced, who financed, and who, then, used the finished products. This approach is based on the premises of “global archaeology” as theorized by Tiziano Mannoni and the archaeology of production studies conducted by André Leroi-Gourhan.³³ The data collected through this research are voluminous and varied. Yet, some points remain to be clarified.

Firstly, as was repeatedly mentioned, the quarries studied in this work cannot be dated with precision. We can only consider a broad chronological span of the “pre-industrial era,” in which to place the so-called long Middle Ages (ninth–fourteenth centuries). Only archaeological excavations conducted according to the stratigraphic method can help achieve more refined temporal *termini*. This remains to be done in the future.

Secondly, when it comes to the characterization of workers involved in the different stages of the production process, a number of uncertainties likewise remain, although here too we can propose some hypotheses. A few scattered elements indicate the presence of different levels of products:

1. religious buildings with an important phase of squared and flattened ashlar, crafted by specialized workers.
2. buildings made with ashlar neither squared nor flattened, perhaps to be dated to an early period. This kind of working of the stone indicates a greater speed in collecting raw material, its processing, and its installation.
3. tombstones, used in both the Jewish and the so-called Ōrbēlean cemetery. This product indicates the presence of two more categories of workers: a) manufacturers who produced the semi-finished products, and b) specialized artisans who carved the decorations and the inscriptions. Again, in

this regard, there is a semi-finished block in the Jewish cemetery where partitions were delineated for decorations and inscriptions, but never completed. In the Jewish cemetery, there is also a further small operational detail that is not easy to interpret, but which is potentially intriguing, namely the presence of a lapidary sign [fig. 10]. Considering its shape, it may have been used to provide some positioning information for the block itself, i.e., forming part of professional markings, thus implying a certain division of labor within the production chain. Another case, in the Ōrbēlean cemetery, is a letter placed on one of the short sides of the gravestone, perhaps indicating that an inscription was planned for that side but was never completed. The same sign, however, is present on the E7, MSU 1307 of the Cupola Church, accompanied by another, representing the only two lapidary signs within the religious buildings of Yeghegis [fig. 11].

It is worth adding a few words to begin reflecting on the possible functions of these signs. They may have been used as individual or collective identity signs (marks of quarrymen or stonemasons, for example); position signs, i.e., in which direction the stone was to be positioned in the wall; signs of special elements (longer or shorter than average); quality control signs, accounting marks, or even dismantling signs and signs of provenance. The only other comprehensive study of building and stone production conducted so far in Armenia, relating to the northwestern area has shown the scarcity of such evidence of specific craftsmen on basalt monuments,³⁴ in contrast to what is known for tuff buildings, with the sole exception of the church of Amberd, where a few small letters are present, positioned in one case at the upper right corner of an ashlar and in the other two towards the edges of the ashlar. Certainly, a simple but plausible reason for the lesser presence of lapidary marks on basalt ashlar compared to those in tuff is the very

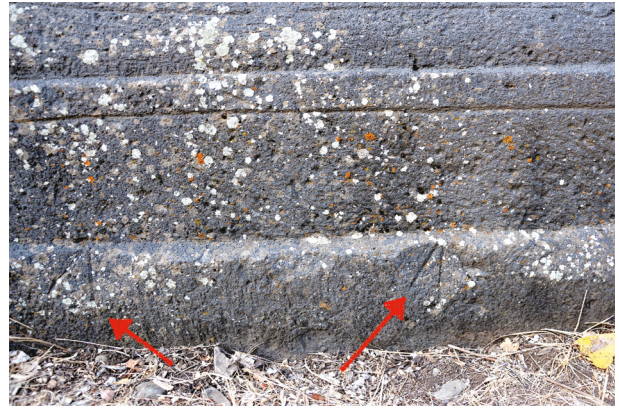
33 Tiziano Mannoni, “Cultura materiale e cultura esistenziale”, in *Lo studio delle tecniche costruttive storiche*, Valeria Pracchi ed., Como 2009, pp. 151–161; André Leroi-Gourhan, *Les racines du monde. Entretiens avec Claude-Henry Rocquet*, Paris 1982.

34 Bessac, “Observations” (n. 5); *Idem*, “Observations sur la construction de la basilique” (n. 27).

nature of the two lithotypes. Tuff is characterized by a certain softness, whereas basalt is decidedly harder, making it less easy to leave marks, whose function could perhaps be more easily achieved by other means. Therefore, it will be ever more important and interesting to understand the significance of the existing marks from Yeghegis, such as on the Cupola Church, currently underway. However, it can be affirmed that their significance is linked to a phase in the stone production cycle to which some scholars have also linked the production of very specific objects found particularly in Armenia, namely lithic models of churches.

One specimen of such a model is preserved in the Regional Museum in Yeghegnadzor, the district center of today's Vayots' Dzor [fig. 12]. This suggestion opens a new research question that cannot be undertaken here, but which has the potential to open a new horizon of exploration. Since a seminal article by Paolo Cuneo, these small stone buildings have continued to fascinate researchers. They are thought to be a kind of 3D model of churches *ante litteram*, found mainly in the territory of historical Armenia, with a few examples outside.³⁵

How do these three-dimensional models fit into research on the stone production cycle? These are stone artefacts, whose creation was, logically, part of an operational chain, but the question they have posed to researchers has been related to their function. Starting with Cuneo, various hypotheses have been suggested regarding them as: 1) representations of donation by, for example, the founder and/or commissioner of the building; 2) a reliquary or a cenotaph; 3) an acroterium; and 4) a maquette, i.e., a true architectural model, an object that is useful and usable in the construction phases of the building, of which it represents a kind of miniaturized three-dimensional elaboration. Among these possibilities, the last idea immediately strikes us for its potential in informing us about the production processes of a stone building. For Bessac, who dealt with this



[fig. 10] Lapidary sign in Jewish cemetery

[fig. 11] Lapidary sign in E7, MSU 1307 of the Cupola Church

35 Paolo Cuneo, "Les Modèles en pierre de l'architecture arménienne", *Revue des études arméniennes*, 6 (1969), pp. 201–232; Christina Maranci, "The Architect Trdat: Building Practices and Cross-Cultural Exchange in Byzantium and Armenia", *The Journal of the Society of Architectural Historians*, 62/3 (2003), pp. 294–305; Bessac, "Observations" (n. 5).

issue most recently, the first three interpretations are quite convincing, but the fourth, the one that is the most interesting for the type of research addressed here, requires further clarification, not least when it comes to defining the meaning of the term “model” in this context. The shape of these sculpted miniature churches is often imprecise, though this may not be apparent to the untrained eye. It is therefore difficult to consider them as real working models or reference models for manufacturers. Bessac wonders whether they could not instead be seen as a means of explaining the project visually. He adds that these schematic three-dimensional representations of churches could have been presented to the commissioners of the work to give them a concrete idea of the form the monument would present once completed. This hypothesis deserves further investigation, and one must define more carefully the meaning and actual stage of the creation of a stone model within a production cycle, perhaps as a kind of proposal submitted to the client, ultimately to the donor, before actual work started. This larger topic, highly relevant to the issues addressed in the present work, focused on stone extraction and use in buildings in one specific site – Yeghegis – will be the subject of a future study by the present author.



[fig. 12] Lithic model of church in Ani / ysu Museum (Yerevan)

