Documentation and Visions for the Reuse of Abandoned Historical Heritage. The Case of Alianello in Basilicata, Italy

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Abstract. The research involves different disciplines concerned with the study, knowledge, and monitoring of heritage from landscape, geological, urban, structural, and architectural points of view, aiming to propose design hypotheses and visions for a new use and regeneration of fragile heritage rendered fragile by natural disasters. The case study examined is the historical center of Alianello, a small municipality in the Lucania region in the province of Matera, consisting of a medieval village that is now completely abandoned and whose buildings are in a state of physical and structural decay that could be easily resolved if recognized and consolidated with awareness and critical knowledge through documentation integrated by technical knowledge. The study was articulated by subdividing the urban fabric into 47 building aggregates, the overall damage conditions of which were analyzed, caused by various geomorphologic and seismic disruptions that led to the abandonment of the built-up area, but did not make the structures completely uninhabitable, for which new forms of reuse were hypothesized to enhance and re-inhabit the village. The research, starting from the example of aggregate no. 25, which is particularly significant for its type of construction, highlights the possibility of reuse not for residential purposes but for tourism and recreation, supported by compatible interventions that respect the authoritative laws of nature, based on stable equilibrium under conditions of minimum energy. The proposed redevelopment could bring economic benefits to the few inhabitants, as well as new investment in the landscape redevelopment of the entire area.

Keywords: Alianello, ghost town, reuse, building damage, risk

1. Introduction

In recent years, since the post-war period, our Country has been the scene of many cases of depopulation, especially if we think about the small towns in the most peripheral inner areas, characterized by the difficulty of connections with large cities and with all the primary services that a community needs to grow and develop. In opposition to this negative trend, Administrations, together with local communities and research and education centers, are experimenting with innovative strategies to suggest sustainable solutions that promote the revitalization of territories. One of these strategies involves especially Schools of Architecture and Engineering that are developing regeneration methods to recover and reuse abandoned building heritage. The aim of the research is therefore to arrive at proposals capable of giving new life to the buildings in the medieval town of "*Alianello Vecchio*", which are no longer fit for habitation due to geomorphological and seismic events in the past (earthquakes of 1857, 1925, and 1980). It is believed that redevelopment can take place by reusing the entire old town, making both the outdoor spaces and the buildings safe, functional, and usable through structural works, even with a change of use, avoiding the loss of the architectural testimonies. Reactivating the medieval town of Alianello, in an age of advanced technology and globalization, may seem counter-current and antithetical, but in reality, it is the only way to appreciate local materials, building techniques of the past, and to analyze and identify the forms of balance that have been established between human intervention, local geological-geomorphological peculiarities, and the forces of nature. A correct valorization will necessarily have to start from the geological knowledge of the territory and its instability and then continue with the assessment of the vulnerability of the existing buildings, concluding with project proposals such as integrated intervention programs, useful to start concrete operative actions of compatible regeneration.

1.1. The "Alianello Vecchio" old town

In Basilicata, on the left side of the Agri river, 30 km from Matera and at an altitude of around 400 meters, more or less in the center of Lucania, lies the abandoned old town of Alianello (Figure 1). It is one of nine abandoned urban centers in Basilicata, one of 229 in Italy, due to natural catastrophic events [1]. Like every urban center in an earthquake-prone area, Alianello suffered severe damage from seismic tremors beginning in 1857, which, over time, led the population to abandon it. Already in 1925, the housing structures were declared unfit for habitation, but the population did not intend to leave their town until 1980 when, due to another powerful earthquake, the Irpina earthquake, to the 57 families were offered new homes in safer areas: "*Alianello di Sotto*", about 3.5 km away with 74 inhabitants, and "*Alianello Nuovo*", 500 meters from the old town, with 196 inhabitants. It was an autonomous municipality, probably founded in 1200, once inhabited by a thriving and self-sufficient community with its own traditions, dialect and handicraft activities such as the brick factory for building from the abundant local clay, then due to progressive depopulation it became a portion of the nearby town of Aliano (Figure 2). Important evidence of human activity dating back to the fifth millennium B.C. has been found in the area. The necropolis found in "*contrada Cazzaiola*", with over a thousand pit tombs dating back to the 7th and 6th centuries B.C., bears witness to the first settlements of the Enotrians of Magna Graecia on the Tyrrhenian and Ionian coasts. Landscape-wise, Alianello overlooks the "*Calanchi* Natural Park". The historic buildings of Alianello are characterized by the use of local materials – limestone or sandstone masonry, terracotta tile roofs, stone or fired brick flooring – which bear witness to a building tradition rooted in the territory. Traditional techniques, such as dry stone or lime mortar masonry, round arches, and barrel or cross vaults, lend solidity and character to the buildings. Particular importance is given to architectural details, such as carved stone portals, carved stone cornices, and wrought iron balconies, which enrich the façades with distinctive elements. The relationship with the landscape is also crucial: the urban fabric, made up of houses nestled along the slopes and stone-paved streets, creates a harmonious whole of great historical and cultural value.

The urban layout of Alianello is compact, consisting of buildings built close together in confined spaces and developed without any planned design. The center does not have any real squares, but it has some basic community facilities, such as shops, craft workshops, a school, and a church with a bell tower. The dwellings, built in masonry using different techniques and over different periods, are generally small in size but ensure good ventilation. The sanitary facilities, on the other hand, are minimal and often makeshift, with rooms less than 2.70 m high built on balconies or landings. According to the testimony of Mattatelli Francesco Paolo [2], these were basic houses, sometimes reduced to a single room, in which the hearth was the center of domestic life, providing heat and light.

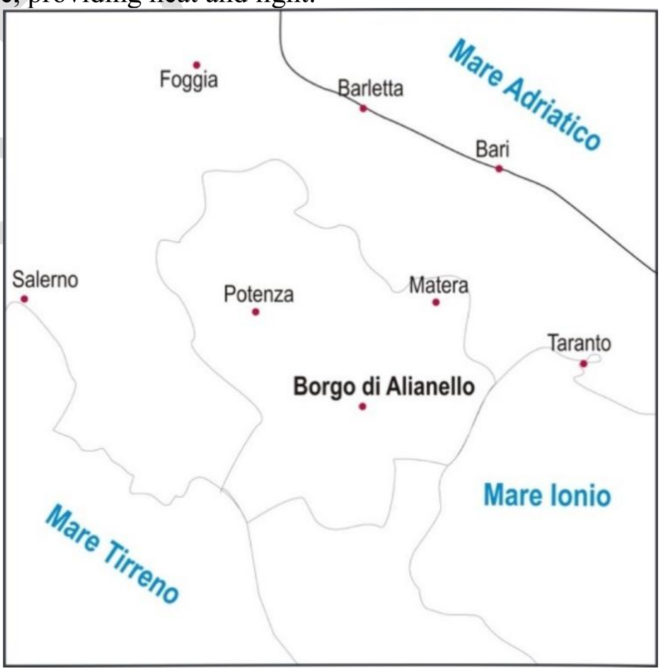

Figure 1 – Location of the town of Alianello (MT). © 2024, Authors.

1.2. Alianello geology

Alianello old town is located on a spur of conglomeratic rock belonging to the Pliocene-Quaternary sedimentary succession of the Sant'Arcangelo Basin, geologically located on the eastern front of the southern Apennine chain (Figure 3). This chain consists of multiple tectonic units stacked with Adriatic vergence [3, 4]. The Pliocene-Quaternary tectonic evolution of the chain has determined the formation of morphological ups and downs distributed alternately along belts oriented in the NW-SE direction. The morphological lowlands, in geology called sedimentary basins, were areas in active sedimentation of debris eroded by the mountains. These basins have been distinguished both on the chain, tectonically defined as: piggy-back, pull-apart, and thrust-top, and to the east of the chain, where it is called the foredeep basin. The Sant'Arcangelo Basin is separated from the foredeep basin (*Avanfossa Bradanica*) by the Valsinni ridge (Figure 3b). For the Sant'Arcangelo Basin tectonic formation different interpretations have been published: i) a pull-apart basin generated by a NW-SE directed left-transcurrent shear zone [5], ii) a piggy-back basin resulting from the growth of the Tursi–Rotondella anticline ridge [6], iii) piggy-back basin only for the upper portion of the sedimentary succession, while the oldest layers, deposited directly on the apennine formations, refer to a top-thrust basin open towards the foredeep [7]. In the Middle Pleistocene, after the sedimentary filling of the Sant'Arcangelo Basin, the entire region underwent a change in geodynamic evolution [8]: the areas previously in subsidence began to rise. At the same time, in the area of the Sant'Arcangelo Basin, there is a change in the tectonic regime, with a transition from compressive to extensive style [9] and the development of a long erosive phase with the formation of the valleys of the Agri and Sinni rivers. The succession of the Sant'Arcangelo Basin consists of about 3,500 m of marine and continental sediments deposited during the Pliocene to Middle Pleistocene [10, 11]. The town of Alianello rises on a steep hill made of a weakly cemented sedimentary succession dipped 12°-15° toward southwest (Figures 3b and 3c). The succession is made from the base by some meters thick, of clay referred to the Biozone MNN19b (Lower Pleistocene) [12]. Followed above, first about 60 m thick of marine sandstone, then 50 m thick of coarsely stratified conglomerate. The buildings of the Alianello settlement rest on the conglomeratic lithology. Furthermore, the succession is cut by a series of normal faults oriented in a SW-NE direction and dipping to the SE. The easternmost one, probably of gravitational origin, bounds the settlement on its south-eastern border, where the houses overlook a steep slope. This slope exhibits vertical fractures that separate rock blocks, which periodically detach and fall to the base of the slope onto a landslide deposit.

Figure 2 – Aliano (MT). View of the city overlooking the "calanchi" ravine. © 2024, Authors.

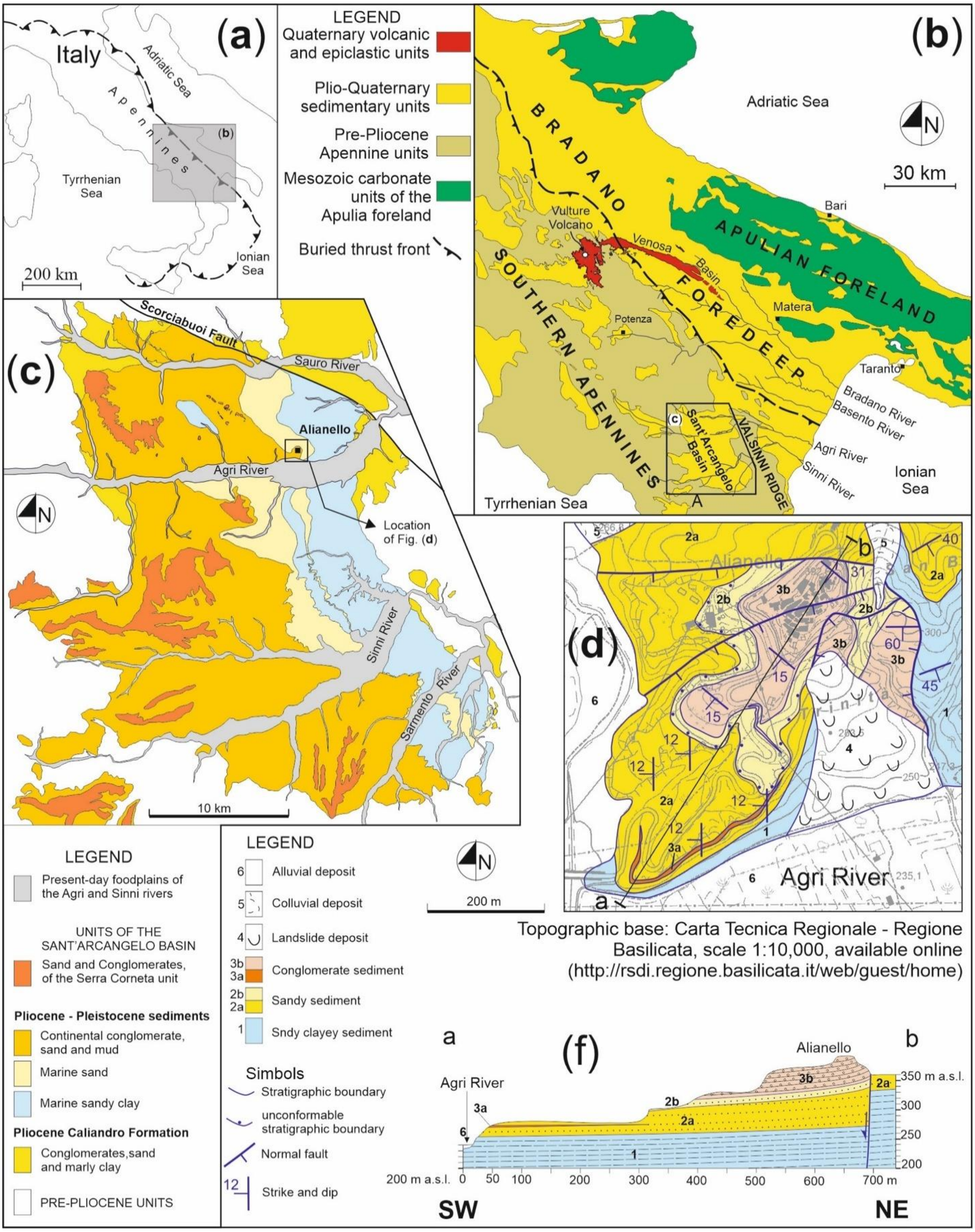

Figure 3 – (a) Location of the Southern Apennines. (b) Geological sketch map of Southern Italy, with location of the Sant'Arcangelo Basin. (c) Geological sketch map of the Pliocene to Quaternary sedimentary units of the Sant'Arcangelo Basin, with the location of Alianello town. (d) Geological map of Alianello town. (f) Geological cross-section through the Alianello old town. © 2024, Authors.

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2. The method: the division of the town into "aggregates"

To formulate redevelopment proposals for the old town, it was necessary to conduct a census, a survey, descriptive analysis, and a damage threshold assessment of the existing dwellings. A census was taken of the building aggregates, i.e. a set of at least two buildings with non-homogeneous construction characteristics and stratified over time, called "structural building unit"' (hereinafter UES) coinciding, in the case of the old town of Alianello, with the concept of a "block", whose solution of continuity from the other aggregates is given by streets, stairways, squares and public open spaces.
The division of the city into clusters is inspired by established methods in urban analysis (see Muratori [13]; Caniggia [14]; Strappa [15]), which interpret the built environment as the result of layered typological and morphological processes. In the case of Alianello, however, the authors have adapted these principles by developing a specific approach aimed at recognizing homogeneous groups of buildings in relation to materials, construction techniques, and topographic layout. In this way, the method remains firmly anchored in the reference literature while offering an original and contextualized interpretation.
In each aggregate, the ESUs are in contact with each other, are interconnected with even partially effective connections, derived from progressive building increments that interact under dynamic action, such as seismic action. A structural unit, also known as a building, has been indicated as a building structure characterized by continuity from roof to foundation with regard to the flow of vertical loads, delimited by open spaces or by effective structural joints or by buildings that are structurally contiguous but typologically different. In the case of Alianello, 47 blocks were identified, of which 17 were building aggregates, structurally independent of buildings in the immediate proximity, and 30 individual building units (Figure 4). Table 1 shows the shape and main dimensions of only some of the aggregates for reasons of brevity.

2.1 The aggregate 25

Among the clusters in the old town, attention was focused on cluster 25 (Figures 4 and 5), selected because it is representative of the typological and constructional complexity of Alianello. It comprises an adequate number of building units (four), sufficient to describe the variety of constructional solutions found in the old town. Furthermore, the block is well defined in relation to the surrounding fabric, a condition that facilitates its analysis and unified interpretation.
Its internal characteristics make it particularly significant: each building is the result of extensions and additions carried out at different times and with heterogeneous materials, ranging from rough masonry with disordered stones and reinforcements to perforated concrete blocks; from vaulted roofs to floors with metal beams, mixed solutions with vaults and concrete slabs, and wooden structures (see Table 2). The coexistence of different techniques and the absence of seismic joints provide an example of the structural vulnerabilities widespread throughout the old town.
The present work includes a summary of the extensive database containing all the geometric elements and structural characteristics for assessing seismic vulnerability.

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Table 1 – Shape and size of some blocks.

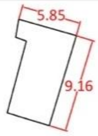
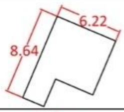
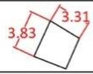
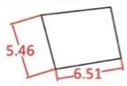
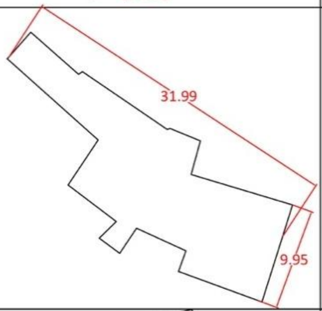
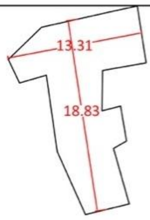
Plan	Block	Building	Main Dimensions (m)
	1	Single unit	9,16*5,85
	2	Single unit	8,64*6,22
	3	Single unit	3,85*3,31
	4	Single unit	6,51*5,46
	5	Aggregate	31,99*9,95
	25	Aggregate	18,83*13,31

Figure 4 – The 47 blocks of "Alianello Vecchio". © 2024, Authors.

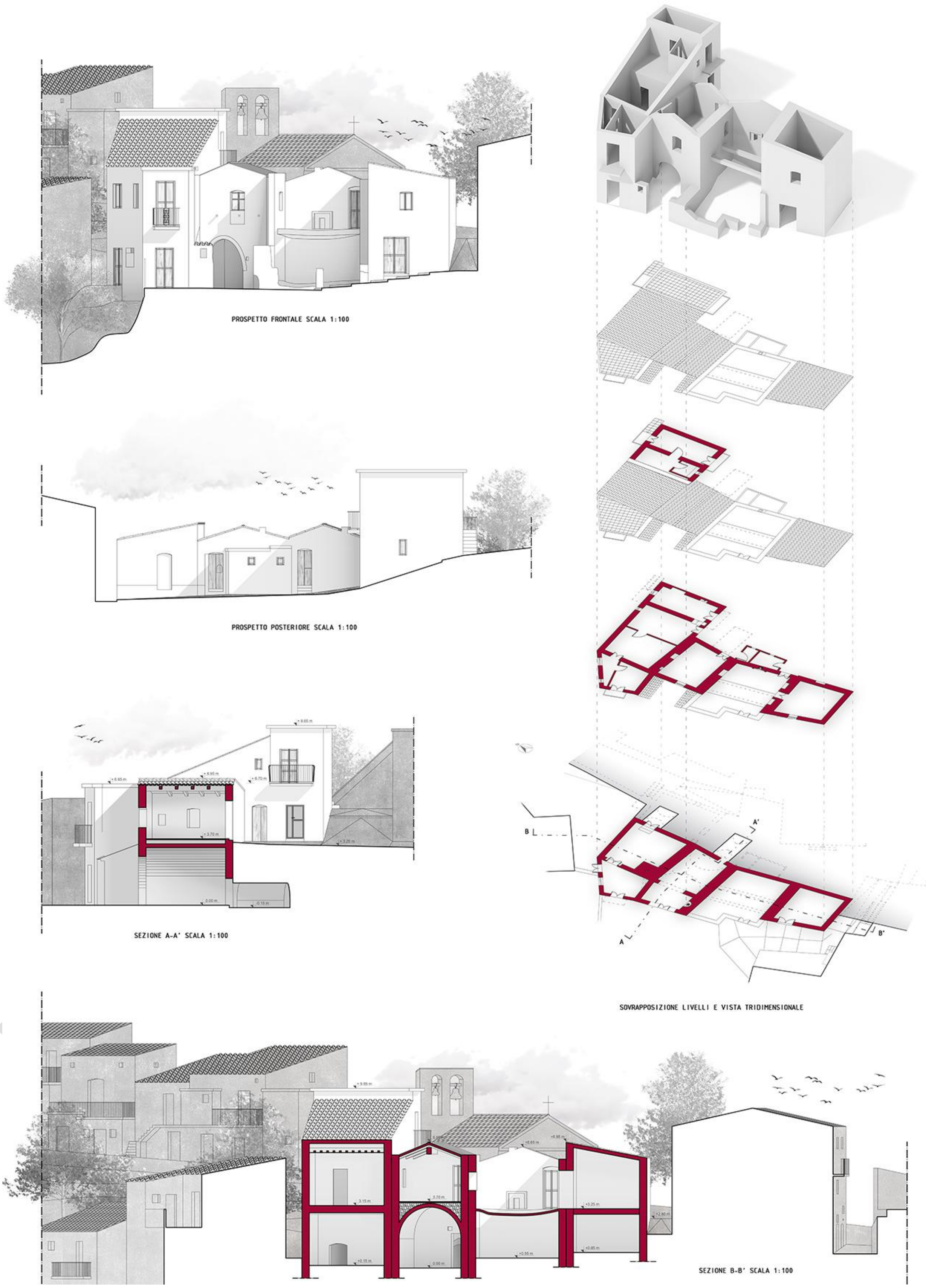


Figure 5 – Plans, sections, elevation, and axonometric view of the aggregate 25. © 2024, Authors.

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Table 2 shows the geometric and structural characteristics of aggregate 25 and of each building that comprises it. It is evident that it is a masonry aggregate, although built at different times and with different construction techniques for each of its parts. With regard to the vertical structures, “Buildings 25 a, b, c, and d” can be distinguished; these are made of irregularly textured and poor quality masonry, with shapeless elements (large, medium and small conglomerate clasts, sometimes flat) with sharply rounded corners, sometimes interspersed with pseudo-regular shaped brickwork, which shows highly vulnerable performance due to out-of-plane actions, with a tendency for the masonry apparatus to break up and flake off, also due to instability, under vertical loads, of the individual faces that are poorly connected or not connected. The walls exhibit low resistance to in-plane actions, not because of the intrinsic low resistance of the conglomerate terms, but because of the mortar and the low friction developed between the heterogeneous stone aggregates, given the configuration of the wall unit. “Building 25a” shows an extension on the ground floor made of masonry with a regular texture and of good quality given by cement bricks, which shows a favorable performance characterized by low vulnerability for out-of-plane actions, although the walls are not well constrained above and below the floors, capable of redistributing seismic actions to the walls parallel to the action, with monolithic performance of the wall itself; medium or high resistance to actions in the plane of the wall, due to the intrinsic resistance of the materials, in particular the mortar, and/or due to the friction that may develop between the blocks or stone elements, in relation to the regularity of the wall configuration. Of course, the regularity of the texture alone is not a sufficient condition to consider masonry of a good standard. As far as horizontal diaphragms are concerned, we distinguish:

- the vaulted horizons of the basement and ground floor of “Building 25b” (Figure 6a) and the ground floor of “Building 25a” (Figure 6b) from all others that are flat structures with deformable or semi-deformable slabs. The vaults on the ground floor of buildings 25a and 25b are without chains, and the structures are already pushing under the action of vertical loads alone. This push may increase due to seismic action that could lead to the collapse out of plane of the walls if there were no counter-thrust from the two adjacent buildings;
- the floor consisting of beams with deformable slab of the 25a all-storey and 25d first floor (Figure 6c);
- the horizontal components of “Building 25c” (now collapsed) and 25d on the ground floor (Figure 6d) are made of timber and double frames (beams and rafters) with simple wooden planking, with lapilli or rubble slabs. There is probably stiffening by means of double planking or a slab connected to the beams. The deformability and/or low resistance of this type means that, even if they are well connected to the vertical structure (a condition that was not found in any of the floors analyzed), they are not capable of constituting a constraint on the walls stressed out of plane, nor of redistributing the seismic forces between the walls stressed in plane. It may therefore happen that these horizons stress the walls out of plane, facilitating collapse.
- The floor slab of the ground floor of the first room, rather recent extension, of “Building 25a” (Figure 6e) is a semi-rigid floor slab made of girders and flat soffit slabs with a shaved upper slab. The stiffness and strength of this floor, with a small span in the case of “Building 25a”, if well connected to the vertical structure by means of a kerb and diffuse seams, are capable of constituting sufficiently rigid constraints on the walls stressed out of plane and redistributing the seismic forces between the walls parallel to the direction of action, which enclose the floor field. These floors, on the other hand, are not sufficiently rigid to cause a redistribution of seismic forces between all the walls of the building.

With regard to covers, Table 2 systematically lists the characteristics of each building unit in “Aggregate 25”, highlighting the type of roof, its weight, and any pushing behavior. These data are not only reported as a technical description but also serve as the basis for assessing the consequences for the overall behavior of the structural system under seismic conditions.

Table 2 – The geometric and structural characteristics of the aggregate 25.

Number and BUILDING TYPE	FLOOR	STANZE	Measured dimensions			Structural typology				Condition of finishes	Vertical connections	BALCONIES	Extensions added at a later date	Outbuildings / ancillary areas	INTENDED USE
			INTERNAL HEIGHT		WALL THICKNESS	HORIZONTAL ELEMENTS	MATERIAL OF HORIZONTAL STRUCTURES	MATERIAL OF EXTERNAL VERTICAL STRUCTURES	ENTRANCE LINTEL MATERIAL	Plastered walls	External/internal staircases or trapdoors				
			max (m)	min (m)	m (media)										
25/A END BUILDING	ground floor	Entrance	3.11	3.11	0.30	flat slab	Steel I-beams with clay block infill	squared cement blocks	clay brick tile	NO	NO	NO	YES	Side garden with access from the first room	POSSIBLE SHOP
		Room with oven	2.88	2.80	0.40	vaulted slab (small vaults)	iron I-beams and small vaults in solid clay bricks	rubble masonry of various sizes and solid clay bricks	segmental arch in solid clay bricks	YES	NO		NO		
		Cellar	1.80	0.84	0.40	barrel vault	vault in solid clay bricks	solid clay bricks	segmental arch in solid clay bricks	NO	YES – 3 internal risers (down)		NO		
	first floor	Entrance/ Living room	2.90	2.90	0.40	flat slab	false ceiling in wood, plaster and lath; slab partly with reeds and partly with clay brick tiles and iron beams	rubble masonry of various sizes and solid clay bricks	segmental arch in solid clay bricks	YES	NO	YES in the bathroom	NO	NO	DWELLING
		Kitchen	2.60	2.60	0.40	flat slab	slab of clay brick tiles and iron/I-beams	rubble masonry of various sizes and solid clay bricks		YES	YES – 2 internal risers (up)		YES		
		Bedroom	2.90	2.90	0.40	flat slab	false ceiling in wood, plaster and lath; wooden and reed slab	rubble masonry of various sizes and solid clay bricks		YES	NO		NO		
		Bathroom	2.60	2.60	0.40	flat roof	slab with hollow clay blocks	squared cement blocks		YES	NO		YES		
		Hallway	2.60	2.60	0.40	flat roof	slab with hollow clay blocks	squared cement blocks		YES	NO		YES		
	second floor	Entrance	2.63	2.63	0.40	flat roof	reinforced concrete slab	solid clay bricks	Hollow clay tile	YES	YES – external access stair, 5 risers	YES in the entrance room	YES	NO	DWELLING
		Attic	2.63	0.70	0.40	single-pitch roof	wood beams and joists with roofing of reeds, mortar and tiles	rubble masonry of various sizes and solid clay bricks		YES			NO		
		Bathroom	2.63	2.00	0.08	single-pitch roof				YES			YES – bathroom created in the attic		
25/B INTERNAL BUILDING	ground floor	Entrance with oven	3.00	2.00	0.40	single-pitch roof	PARTIAL COLLAPSE – wood beams and joists with roofing of reeds, mortar and tiles	PARTIAL COLLAPSE – rubble masonry of various sizes and solid clay bricks	no longer exists	YES	NO	NO	NO	NO	POSSIBLE SHOP
		Bedroom	3.34	1.60	0.40	barrel vault	solid clay bricks	rubble masonry of various sizes and solid clay bricks	round arch in solid clay bricks (Hmax= 2.83 m; Hmin= 1.10 m)	YES	NO		NO		
		Cellar	1.80	0.82	0.40	barrel vault	solid clay bricks	rubble masonry of various sizes and solid clay bricks	excavated under the road, lined with solid clay bricks, pointed arch	YES	NO		NO		
	first floor	Single room	2.96	2.34	0.40	gable roof	wood beams and joists with roofing of reeds, mortar and tiles	rubble masonry of various sizes and solid clay bricks	segmental arch in solid clay bricks	YES	NO	NO	YES – bathroom created outside the original envelope	NO	DWELLING
25/C INTERNAL BUILDING	ground floor	Single room	2.40	2.40	0.40	flat slab	PARTIAL COLLAPSE – wooden beams (still visible) and wood boards	PARTIAL COLLAPSE – rubble masonry of various sizes and solid clay bricks	TOTAL COLLAPSE	YES	NO	NO	NO	NO	POSSIBLE STORAGE
	first floor	Single room	3.20	2.56	0.40	gable roof	TOTAL COLLAPSE	PARTIAL COLLAPSE – rubble masonry of various sizes and solid clay bricks	segmental arch in solid clay bricks	YES	NO	NOT SURVEYABLE	YES – bathroom created outside the original envelope	NO	DWELLING
25/D END BUILDING	ground floor	Single room	2.10	2.10	0.40	flat slab	wood beams and wood boards	rubble masonry of various sizes and solid clay bricks	wooden lintel	YES	NO	NO	NO	NO	POSSIBLE STORAGE
	first floor	Single room	3.40	2.95	0.40	single-pitch roof	assumed roof with iron I-beams and clay brick tiles	rubble masonry of various sizes and solid clay bricks	segmental arch in solid clay bricks – entrance walled up	YES	NO	NO	NO	NO	DWELLING

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For example, Table 2 shows that the pitched roof of "Building 25b" (ground floor) has a more pronounced thrusting effect than the flat floor of "Building 25a" (ground floor, entrance rooms and oven room), which does not generate significant thrusts.
The table, therefore, does not merely list construction types and geometries, but directly provides the elements necessary to understand and argue the seismic vulnerability of individual building units. This reading is then summarized in Table 3, which collects the overall results of the analysis.
In all cases, with the exception of only the second-floor compartment of "Building 25a", it is a pushing roof (Figure 7), since it lacks kerbstones and chains, but is light since it consists of timber and reeds in addition to tiles. The dangers are essentially related to the aggravation of the horizontal thrusts on the supporting walls due to the seismic forces; the condition would be favorable if the roof structure had sufficient rigidity and strength in its plane, so as to also play a positive role in terms of improving the overall box-like performance of the masonry. The roofing of the second-floor room in "Building 25a" is of the heavy pushing type, although small in span. This is undoubtedly a serious condition, as the high mass causes the emergence of considerable seismic forces, while the pushing effect favors the out-of-plane collapse of the walls below. Other structural characteristics concern the possible presence of partitions, the presence and type of stairs, the foundations, if visible, and any structural work carried out.

Figure 6 – a: brick barrel vault building 25b ground floor. b: brick barrel vault building 25a cellar ground floor. c: floor with beams and vaults (beams with deformable slab) building 25a ground floor. d: wooden floor with simple framework planking (beams with deformable slab) building 25d ground floor. e: floor with beams and large planks (beams with semi-rigid slab) building 25a first floor. © 2024, Authors.

Figure 7 – a: roofing of building 25b beams, reeds, and tiles. b: roofing of building 25a, 2nd floor room under expansion. c: roofing of building 25a beams, reeds, and tiles. © 2024, Authors.

3. Discussion: assessment of building damage conditions

The overall damage condition of the Alianello aggregates is the result of an accumulation process of damage as found today (May 2024), the causes of which are not individually identifiable (principle of overlapping effects) since the structures have been subjected to extensions, elevations, modifications, damage of various kinds and subsequent repairs in the past, abandonment not known either in terms of manner or timing. For damage estimation, it was therefore not necessary to isolate the individual event in order to assess the effect on the structure, but the level was assessed for the only purpose of

reuse. For the assessment of structural damage, understood as a change in the load-bearing capacity of the structure compared to its original state and the type of load-bearing structure, a table was specially prepared. It was not possible to use the method based on either the European macroseismic scale [16] or the Gndt survey sheet [17], which refer to a single seismic event and are also suitable for risk assessment, although the aforementioned table takes due account of this. The damages found in the table are the apparent ones [18], i.e., all those found, on sight, on the structural components at the time of the inspection. The table was structured taking into account that the buildings: are structural units of the ordinary building type for housing and services and therefore do not include those of a specialized type (industrial warehouses, sports buildings, theatres, etc.), with the only exception of the village church, which does not however have any special characteristics of monumental assets; they belong to aggregates that are not very large, with a simple plan; they were built, in any case, with a masonry load-bearing structure, even if of different types and in different periods; they have been subject to extensions and elevations. The damages noted are those in the opinion of the authors, personally found by sight (apparent), on structural and non-structural but relevant components, carried out during the inspections from January to May 2024, regardless of which event generated them, so they represent the overall existing damage on the structures, as they are to date. Damage to buildings was divided into percentages as follows: No damage < 10% (D0); Slight damage 10-20% (D1); Medium damage 20-40% (D2); Severe damage 40-60% (D3); Very severe damage 60-80% (D4); Total damage 80-90% (D5).
Table 3 completed for Aggregate No. 25 is shown below.

Table 3 – Extent and level of structural damage of aggregate 25.

	Structural Units of Aggregate 25								
	25a pt	**25a pl**	**25a p II**	**25b pt**	**25b pl**	**25c pt**	**25c pl**	**25d pt**	**25d pl**
Extent and level of damage	15% - D1	25% - D2	25% - D2	45% - D3	65% - D4	85% - D5	85% - D5	15% - D1	25% - D2
Vertical masonry structures	<1/3	1/3–2/3	<1/3	<1/3	1/3–2/3	>2/3	>2/3	<1/3	1/3–2/3
Horizontal structures	<1/3	1/3–2/3	<1/3	>2/3 collapsed extension		>2/3 (collapsed)		<1/3	
Roof		>2/3			>2/3 (collapsed)		>2/3 (collapsed)		1/3–2/3
Stairs	no stairs	no stairs	<1/3	no stairs	no stairs	no stairs	no stairs	no stairs	no stairs
Partitions	<1/3	<1/3	1/3–2/3	<1/3	<1/3	>2/3	>2/3	<1/3	<1/3
Risk indicators (collapse, uninhabitability)	Uninhabitable	Uninhabitable	Uninhabitable	Floor collapse	Roof collapse	Floor collapse	Roof collapse	Uninhabitable	Uninhabitable
General forecast of possible improvement interventions	Extension	Masonry, beams, floors, ties	Masonry, beams, roofs, ties	Remove collapsed extension; intervene on masonry, ties, beams	Masonry, beams, roof, ties	Remove collapsed extension; rebuild floor; intervene on masonry, ties, beams	Masonry, beams, roof, ties	Masonry, beams, floors, ties	Masonry, beams, roofs, ties

4. Results: project and building intervention proposals

The geological assessment has highlighted some critical issues related to slope stability and ongoing erosion processes, aspects that require further investigation through geotechnical surveys and targeted monitoring. However, the overall conditions do not show widespread instability phenomena that could irreversibly compromise the old town area.

At the same time, analysis of the structures revealed that, despite seismic vulnerabilities and construction inconsistencies, many buildings retain substantial integrity in their load-bearing walls and a level of deterioration that can be addressed through targeted consolidation and restoration work (Mezzina et al., [19]) or, in the most compromised cases, through demolition and redevelopment as open spaces. The presence of traditional construction techniques, albeit heterogeneous, is a favorable factor for recovery, as it allows the use of compatible and reversible restoration methods. In particular, Mezzapelle et al. [20] emphasize that the seismic vulnerability of historic masonry buildings is strongly linked to material quality and damage mechanisms, and that it is essential to conduct in-depth structural assessments to plan effective consolidation.

Overall, the integration of geological and structural analyses indicates that the restoration of the old town is technically feasible, provided that it is accompanied by a coordinated plan of action that includes geological risk mitigation measures and static consolidation strategies, (Dolce et al., [21]).

Proposals for reuse aimed at revitalizing the historic building heritage, with the aim of stimulating the economic and social development of Alianello Nuovo and neighboring villages, may mainly concern the renovation and safety measures of the buildings. A hypothesis for overall reuse is shown in the master plan in Figure 8.

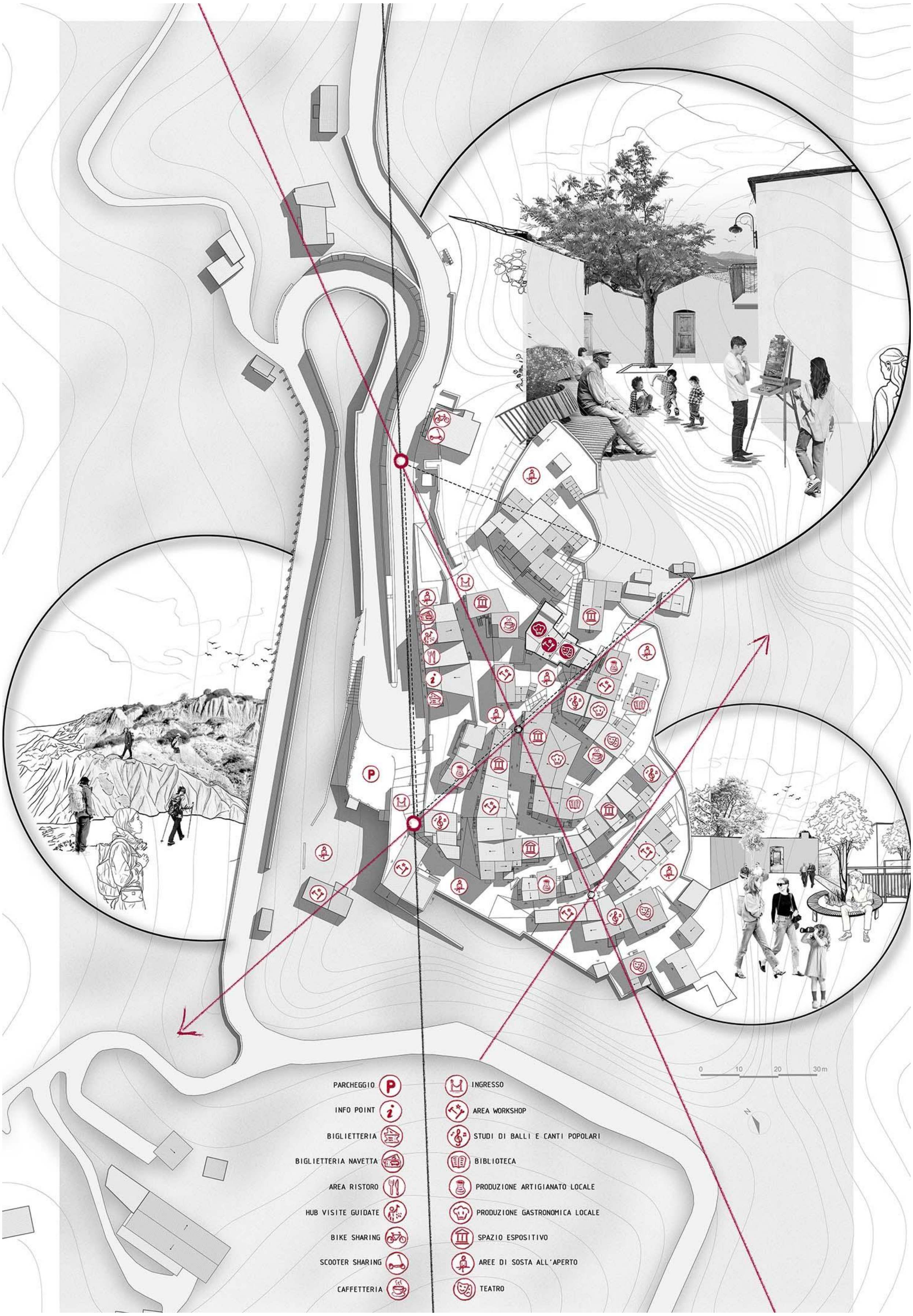

Figure 8 – Masterplan of possible reuses of the buildings of the village of Alianello. © 2024, Authors.

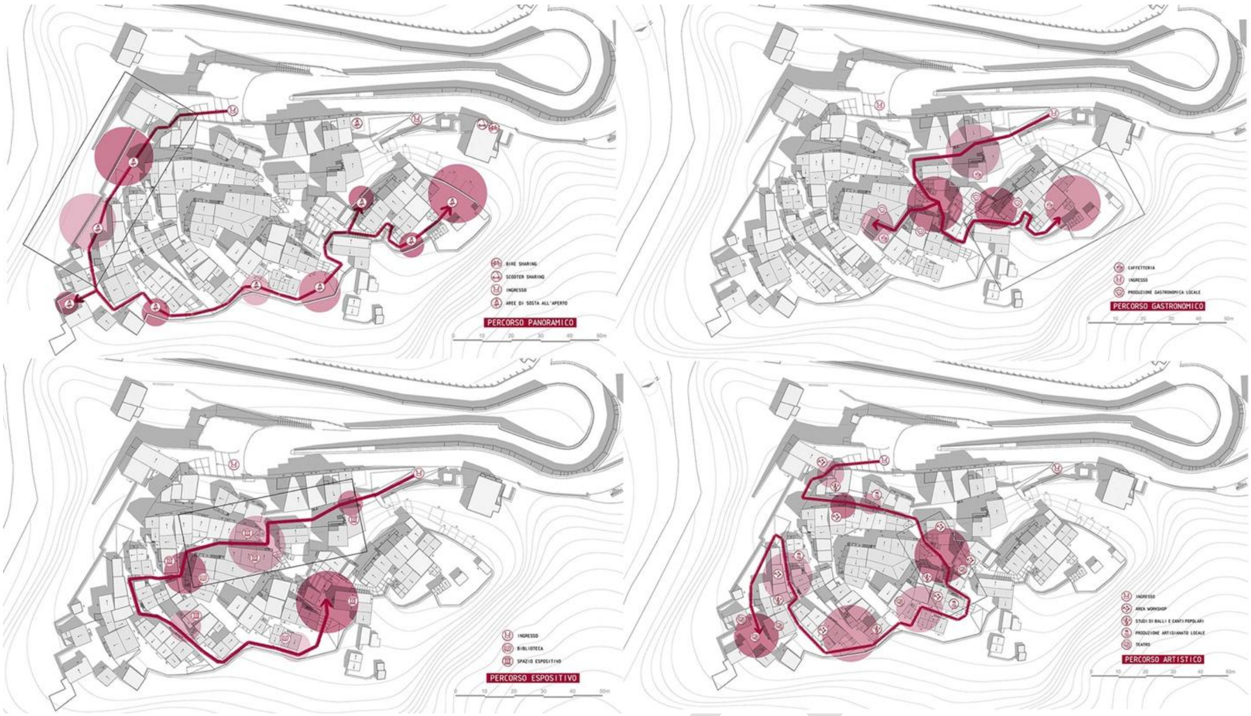

Figure 9 – Project hypotheses of four itineraries to regenerate the old town. © 2024, Authors.

5. Conclusions and future works

The idea that the village could be "reused" arose from the fact that the inspections revealed that the aggregates were not all in serious danger of collapse; the village was not off-limits to pedestrians; there were no obstacles to visits and no emergency intervention works were found on the structures (circling, tie rods, props) or barriers or protection of the streets. Demolitions were probably carried out for safety purposes, but at the moment, no traces have been found. Using "Aggregate 25" as a significant example for the construction type and character of the buildings, the possibility of reusing and revitalizing the village was highlighted, not for residential purposes but for tourism and culture, for short-term stays, events, and film scenes, intervening with sustainable design strategies. Obviously, Table 3 is not sufficient to draw specific indications regarding the structural calculation of the interventions to be carried out and foreseen by the law currently in force, but it is an excellent basis for evaluating the possibility of recovery and for a rough assessment of the costs necessary for the interventions.
The thesis demonstrated in this research is that the redevelopment of a broader nature, with external consequences for the margins of the municipal territory, can be triggered by starting from the recovery and reuse of the entire old town, analyzing the causes of geological instability, and making the structures safe. The surveyed buildings can also be made usable again by imagining possible changes in intended use, trying to maintain the memory of the places through the use of traditional forms, materials, and construction methods. The research also intends to establish a code of good practices [22, 23] of analysis and design to be able to experiment in places with similar characteristics to those analyzed, both from an environmental and historical and architectural point of view. The subsequent work and research phase must therefore concern the geomorphological study of the territory, the knowledge of the type-morphological characters of the architecture and of the urban path, to set up design visions and integrated intervention programs to activate operational regeneration actions compatible with the existing, in a constant dialogue with the local construction tradition and with the earth that hosts us.

Figure 10 – Project hypotheses for the regeneration of the open public spaces in the city center. Views and plan. © 2024, Authors.

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7. Authors Contributions

E. Giaccari has edited the paragraphs 2.1, 3 and 4; M. Calia has edited the paragraphs 1, 2 and 5; P. Giannandrea has edited the paragraph 1.2. All authors has checked and super viewed all the texts and the images and tables.

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