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Stephan Zink, Daniel P. Diffendale, Fabrizio Marra, Jens Pflug, Mario Gaeta, Monica Ceci

The mid-Republican Temples at Largo Argentina in Rome. Quarry Provenience and Construction History of Ancient Roman Lapis Albanus Tuff

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trauert um seine Freunde und Mitglieder

MARIA GIUSEPPINA CERULLI IRELLI
† 5. NOVEMBER 2024



ABSTRACT

The Mid-Republican Temples at Largo Argentina in Rome

Quarry Provenience and Construction History of Ancient Roman Lapis Albanus Tuff
Stephan Zink – Daniel P. Diffendale – Fabrizio Marra – Jens Pflug – Mario Gaeta –
Monica Ceci

Recent research at Largo Argentina in Rome has resulted in the attribution of Italic-Ionic order architectural members in Lapis Albanus ('peperino') tuff to the earliest, 3rd century BCE phases of the so-called Temples A and C. Samples from both the architectural members and the ancient quarry sites of Lapis Albanus deposits at Marino (23 km from Rome) underwent ICP-MS trace-element and thin-section analyses. The results indicate that the material from Temple A is more geochemically homogenous, suggesting it was extracted from a restricted geographical area possibly corresponding to a single quarry, while Temple C reveals more heterogeneous sources. This study marks the first quarry proveniencing of contextualized Lapis Albanus building material, along with the first graphic reconstruction of the earliest columns of Temples A and C. Its results raise a number of questions regarding quarry extraction, distribution models, the constructional use of Lapis Albanus, and the stakeholders involved in the building processes.

KEYWORDS

Archaeometry, Roman Architecture, Quarry Proveniencing, Volcanic Tuff, Topography of Rome, Largo Argentina

The Mid-Republican Temples at Largo Argentina in Rome

Quarry Provenience and Construction History of Ancient Roman Lapis Albanus Tuff

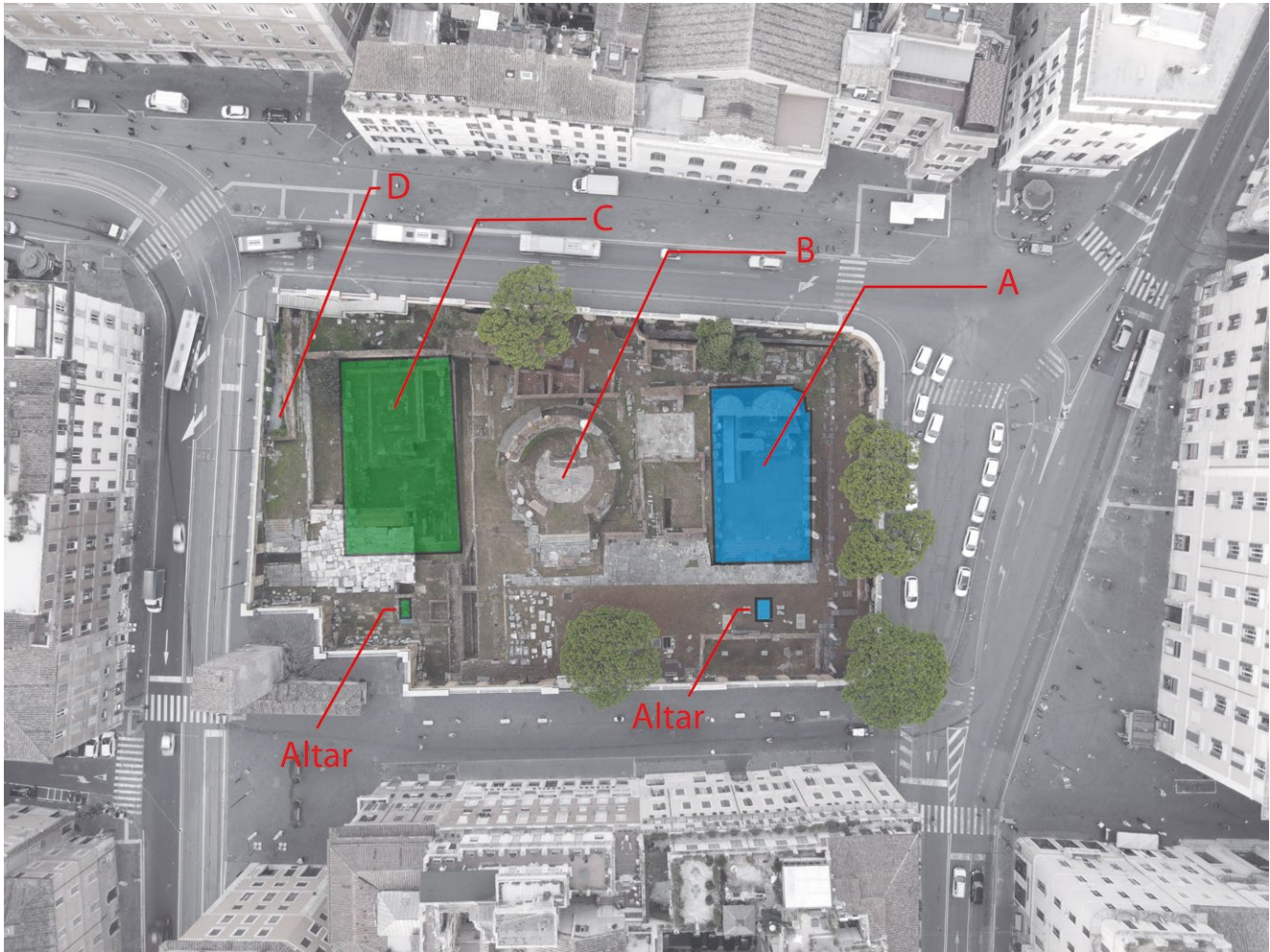
1 Few buildings survive from the 4th and 3rd centuries BCE in Rome. Therefore, the architecture of this period, known as the Middle Republic, remains relatively unknown, especially in comparison to the following Late Republican and Imperial periods. One of the most informative places for the study of this lesser known chapter of architectural history is the archaeological site of Largo Argentina in the center of Rome, where excavations carried out in the 1920s and 30s brought to light a complex with four ancient temples. Lacking clear identification, they were labeled Temples A to D (Fig. 1). The earliest phases of Temples A and C belong to the 3rd century BCE, within the Mid-Republican period. This study attempts to determine the provenience of their principal building stone, a regional, grey-green volcanic tuff known as Lapis Albanus. Methodologically, we bring together a geochemical and microscopical analysis of stone samples, a topographical investigation of the quarry sites, as well as an architectural analysis that provides the basis for a graphic re-contextualization of the dislocated architectural members of Temples A and C.

2 The present study evolved from a collaborative project of the German Archaeological Institute (DAI) and the Sovrintendenza Capitolina ai Beni Culturali, and it was enabled by a DAI research fellowship in 2021. Between 2018 and 2021, the Largo Argentina project undertook a new architectural documentation of the fragmentary remains of Temples A and C and allowed, for the first time, the attribution of a series of architectural members in Lapis Albanus tuff to the earliest, mid-Republican construction phases of Temples A and C¹. So far, earlier or contemporary evidence for the use of this building material, such as at nearby Sant’Omobono, has been limited to platforms and altars². For the moment, the newly attributed architectural fragments of Temples A and C stand as the earliest known instances of the use of Lapis Albanus tuff in monumental columnar architecture at Rome³. This makes them particularly interesting for investigating quarry sources.

1 Zink – Pflug 2019; most comprehensively Zink et al. 2020; further Zink et al. 2021; Zink et al. forthcoming.

2 Diffendale 2016; Diffendale et al. 2016; Diffendale et al. 2019.

3 Although not yet analyzed geochemically, a ‘peperino’ that could well be Lapis Albanus was used in the



1

Fig. 1: The site of Largo Argentina in Rome with the remains of four ancient temples. Temples A and C, along with their altars, are the focus of this study

Lapis Albanus

3 The stone that was used for both the columns and the altars of Temples A and C is known as Lapis Albanus. Cicero, in a fragment of his *Pro Scauro* (delivered 54 BCE), refers to *albanas columnas* (“Alban columns”); similarly, Suetonius, writing of the house of Augustus, mentions *porticus breves Albanarum columnarum* (“low porticos of Alban columns,” 72.1). Vitruvius writes of *lapidicinae albae* (“Alban quarries,” 2.7.1); Tacitus of *saxum albanum* (*Ann.* 15.43.2). There has never been doubt that this Latin term refers to a volcanic rock exploited from antiquity to the 20th century in the Alban Hills south-east of Rome⁴. It is a grey-green tuff which originates from a massive, thickened facies of phreatomagmatic pyroclastic currents and is locally channelized in topographic low points at the geological type locality of the Marino quarries⁵. An explosive volcanic eruption that occurred 36,000 BP at the Albano maar triggered these depositions⁶. The strongly lithified facies crops out extensively along the Pietrare stream valley (*Valle delle Pietrare* or *Pietrare*, “Valley of the Quarries”), which extends from the northern rim of the

reconstruction of the temple of Sol Indiges at Lavinium, dated to the 2nd quarter of the 3rd c. BCE: Jaia 2012, 613.

4 Marra et al. 2022. It is worth noting that ‘Lapis Albanus’ is now used as a geological name of this particular volcanic rock; while it is certain that this geological ‘Lapis Albanus’ was referred to as *lapis albanus* by the ancients, it cannot be ruled out that the visually-similar products of other, minor eruptions were also referred to by this term. Thus we maintain a typographic distinction between Lapis Albanus as geologically identified and *lapis albanus* as attested in ancient texts.

5 e.g., Giordano et al. 2002.

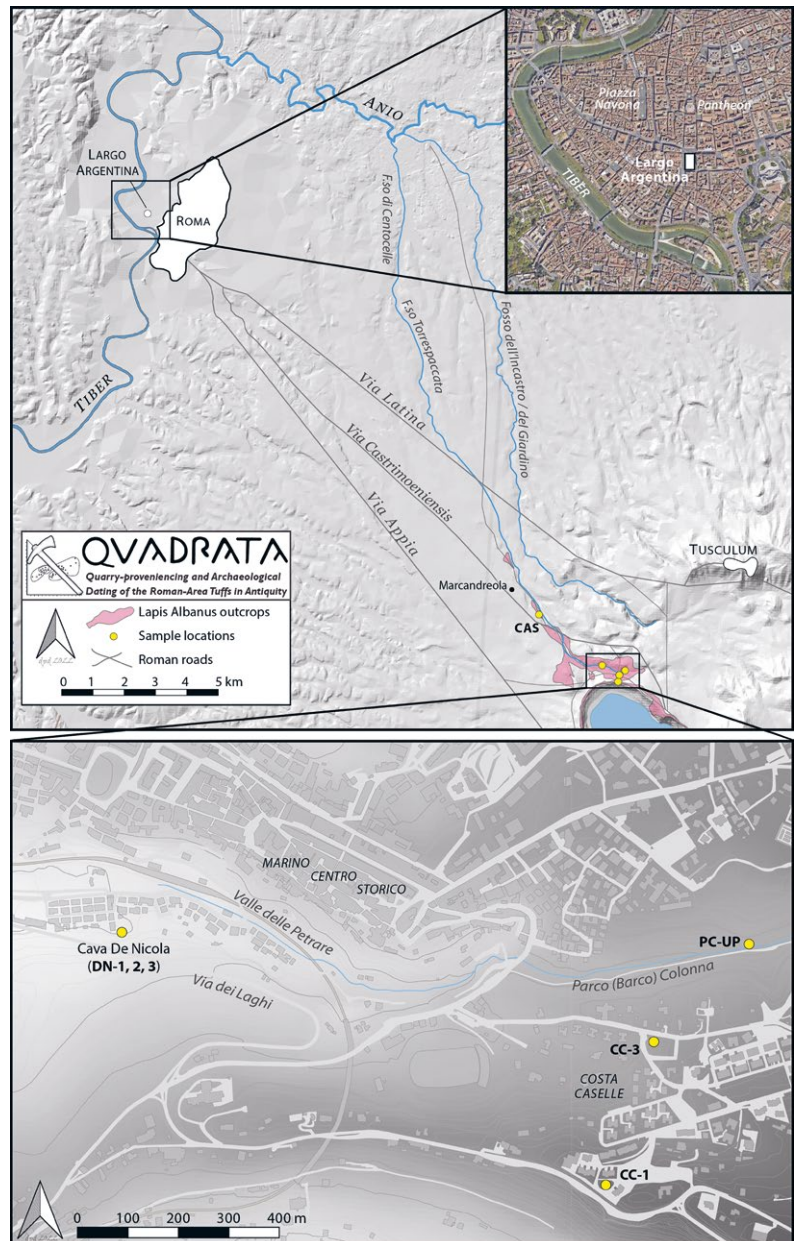
6 Peperino Albano, Freda et al. 2006; Giaccio et al. 2007; Giaccio et al. 2009.

Albano crater westward, passing the center of the city of Marino (Fig. 2)⁷. In the central part of the outcropping area, the exposed faces reach 15 m in height, and this is also the location of the Cava De Nicola (Fig. 3).

4 Contrary to earlier scholarship, which held that Lapis Albanus was introduced to the architecture of the city of Rome only following the construction of the Via Appia in 312 BCE⁸, recent geochemical analysis from the site of Sant’Omobono has demonstrated that this date should be moved back at least to the early 5th century BCE⁹; contemporary sarcophagi and urns, not yet subjected to geochemical analysis, were very likely also made from this rock, to judge from macroscopic analysis¹⁰. The exploitation of Lapis Albanus was favored by its uniaxial compressive strength. Along with the Lapis Gabinus erupted by the Castiglione Crater, it was more compact than all other tuffs exploited from the Alban Hills and Monti Sabatini volcanic districts¹¹. It was, therefore, often employed in architectural elements sustaining high pressures, such as columns, load-bearing walls, and arches¹². Its fine grain-size and strong lithification also made it a preferred stone for contexts in which intricate detail was required, such as architectural moldings, capitals, bases, inscriptions, and sarcophagi.

Preparatory Research and Evolving Questions

5 So far, the Largo Argentina project has revised the chronological development of Temple A and established an updated series of its successive layouts and designs¹³. Currently in progress is a virtual reconstruction of the earliest, mid-Republican, construction phases of Temples A and C. This reconstruction is possible because substantial remains of these phases are still preserved in situ in the form of podia, cella walls, and altars. In the case of Temple A, most of the remains of the earliest construction phase are hidden in a subterranean level of the site, artificially created after the 20th century



2

Fig. 2: Geological base maps showing the location of Rome, Largo Argentina, and the Lapis Albanus deposits in the modern city of Marino and in the area of the Valle delle Petrare

7 See now also Hopkins 2024, 3–5.

8 e.g., Frank 1924; Lugli 1957.

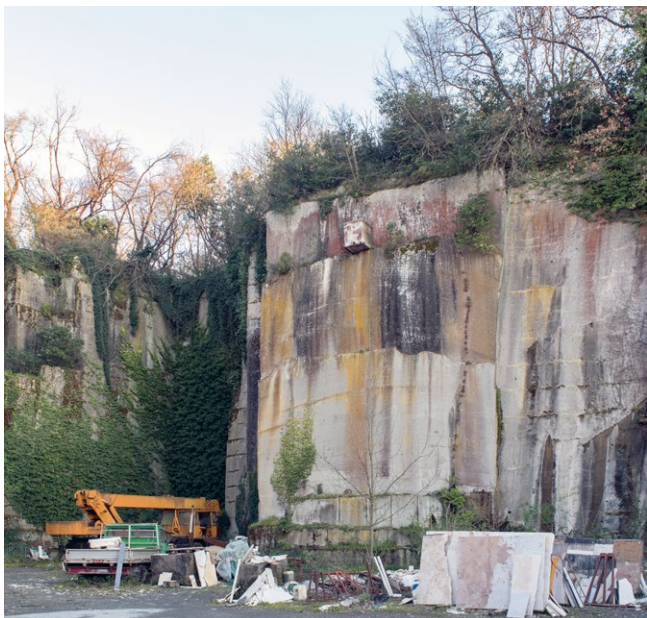
9 Farr et al. 2015; Diffendale et al. 2019.

10 Most famously the ‘peperino’ urn that contained a smaller urn in Greek marble from Tomb 193 of the Esquiline necropolis, ca. 510 BCE, along with monolithic sarcophagi from the same necropolis and Largo Magnanapoli: Colonna 1977, 137–146. 149; Cifani 2008, 325 f.; see also Hopkins 2016, 135 f.

11 See Farr et al. 2015.

12 Jackson – Marra 2006.

13 For this and the following paragraph in more detail, Zink et al. 2020.



3

Fig. 3: View of the Cava de Nicola near Marino in the Valle delle Petrare

excavations (Fig. 4). Additionally, about 150 architectural fragments in Lapis Albanus, originating from columns, entablatures, and exterior cella decorations, were found at the site between 1926 and 1928¹⁴. These pieces had been removed from their original context already during an ancient rebuilding, when the columns of the earliest temple were smashed to pieces and probably re-used as fill in the construction trenches of the successive phase. After their discovery, the Lapis Albanus fragments were brought to the storage rooms at the archaeological site, along with thousands of other architectural pieces that were unearthed during the excavations.

6 Fortunately for the current study, Lapis Albanus was used as a building material at Largo Argentina only during the earliest, mid-Republican construction phases. This means that the preserved fragments in this material can only belong to Temples A and C, as they are the only buildings that existed during this period. Currently, however, the material from Temples A and C is mixed up, and therefore the first challenge for recon-

structing the temples' original elevations was to define criteria for identifying the pieces of each temple. The different sizes of the buildings (in its first phase, C was substantially larger than A) provided the first clue, followed by observations on technical and stylistic differences that evolved from our execution of analytical architectural drawings. As a result, it was possible to graphically reconstruct an exemplary Italic-Ionic-order column of each temple as a three-dimensional puzzle (Fig. 5). This spatial re-contextualization of the architectural elements is a key component of the present study.

7 Our attempt to provenience the Lapis Albanus tuff employed at Temples A and C was sparked by several lines of inquiry. From an archaeometric perspective, the question was whether or not it was possible to match the building stone with one of the known quarries around Rome. Here, our work connects to the project "Quarry-provenience and Archaeological Dating of the Roman-Area Tuffs in Antiquity" (QUADRATA), which marks the first systematic study of the ancient quarries of Lapis Albanus¹⁵.

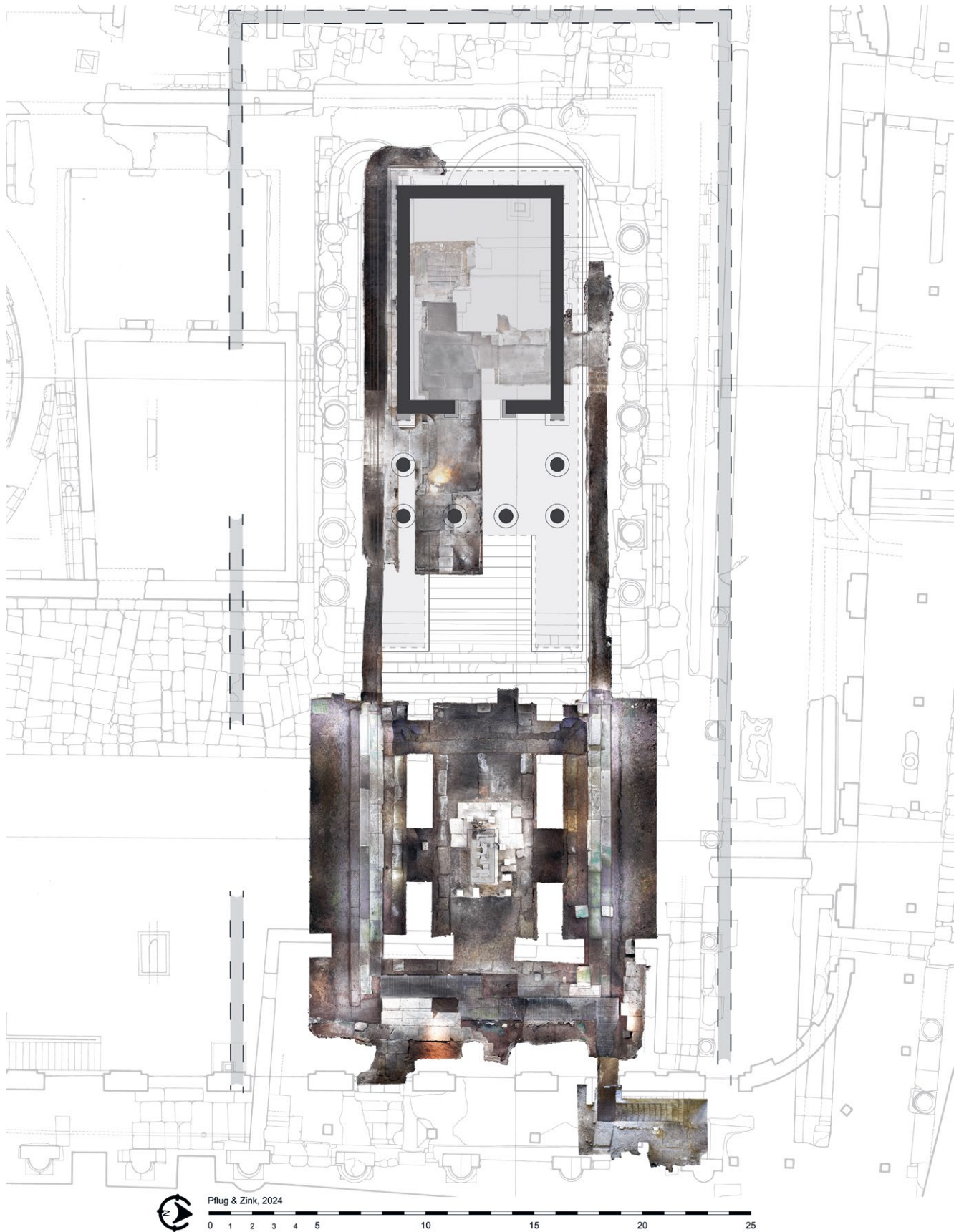
8 From a constructional viewpoint, we were curious whether craftsmen used different quarries, and perhaps qualities, of Lapis Albanus for specific parts of the columns. For example, was a particular source used for the column capitals with their intricately carved and complex designs? Moreover, we hoped to gain data to enrich our understanding of the construction process and the different parties involved in it (quarry providers, building contractors, building patrons). In sampling the altars in front of each temple we saw a chance to gain insights into the chronology of Lapis Albanus quarrying. The altar in front of Temple C carries an inscription (ILLRP 121) that suggests its construction in 142 BCE, thus over a century after the temple's first dedication¹⁶.

9 To briefly anticipate the results, we were able to answer the question of provenience relatively well. We can geochemically distinguish two likely areas of extraction. The first, comprising samples DN-1, DN-2, DN-3, and PC-UP, represents the lower and middle Valle delle Petrare, characterized by a deep pyroclastic-flow deposit within the stream valley, where ancient and modern quarries are known; we will

14 Marchetti Longhi 1936, however overlooking the significance of these architectural elements, which consequently never played a role in subsequent scholarship.

15 Diffendale –Marra forthcoming.

16 Coarelli 2014, 134–144; Cavallero 2018, 198 f. n. 66; Ceci 2020, 79, in particular note 18.



4

Fig. 4: The earliest, mid-Republican phase of Temple A in context (scale 1:250). The photogrammetry (SfM) captures the artificial under-ground level with the remains of Temple A (phase 1); superimposed is the reconstructed ground plan, with an underlayer for orientation displaying a plan of the remains as visible above ground

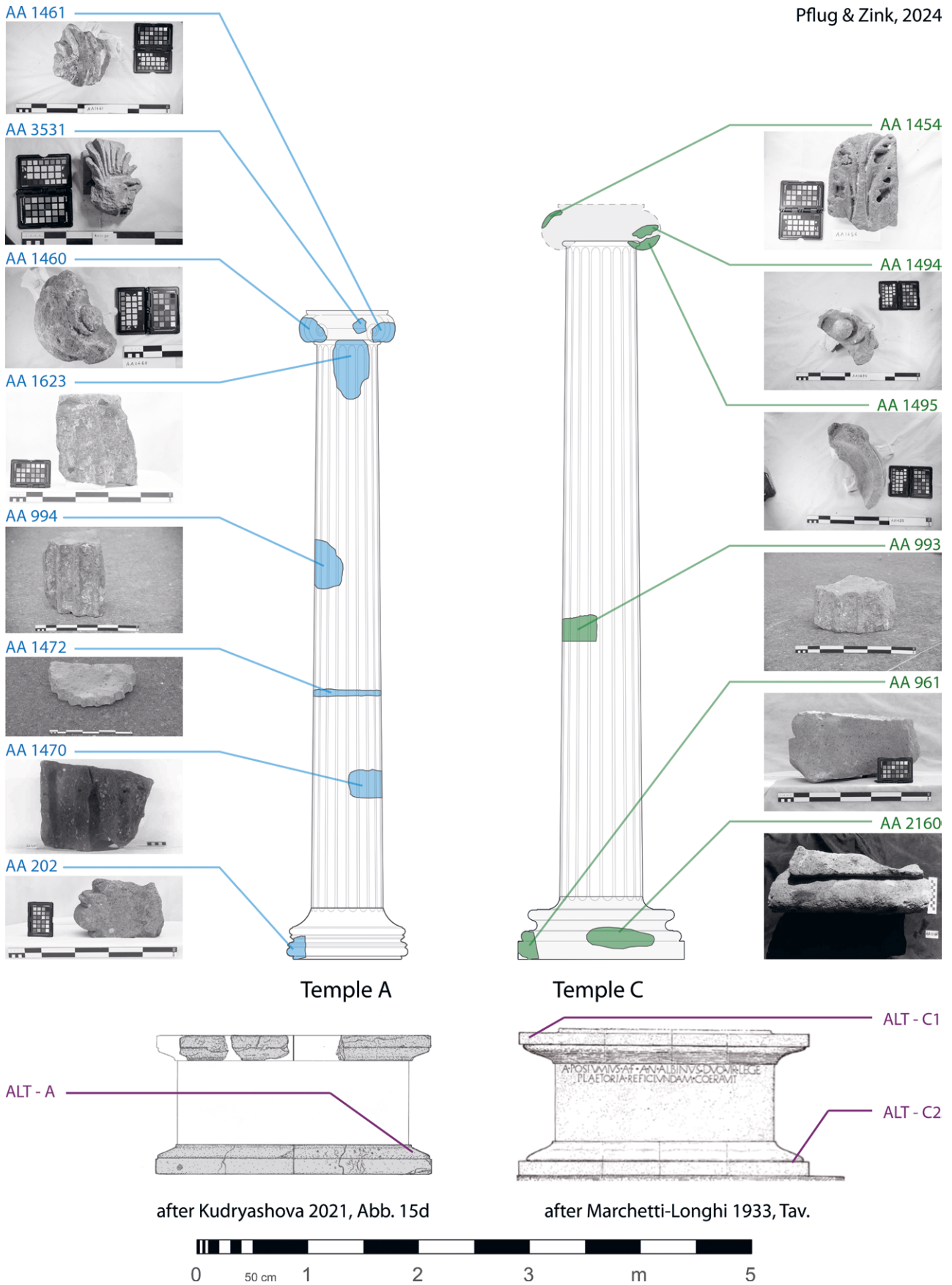


Fig. 5: Upper register: schematic reconstructions of an Italic-Ionic column of the earliest phases of Temples A (left) and C (right), with the architectural fragments analyzed in the course of this study (scale 1:50). Lower register: reconstructions of the earliest altars of Temple A (left, south elevation) and C (right, north elevation) with location of samples indicated

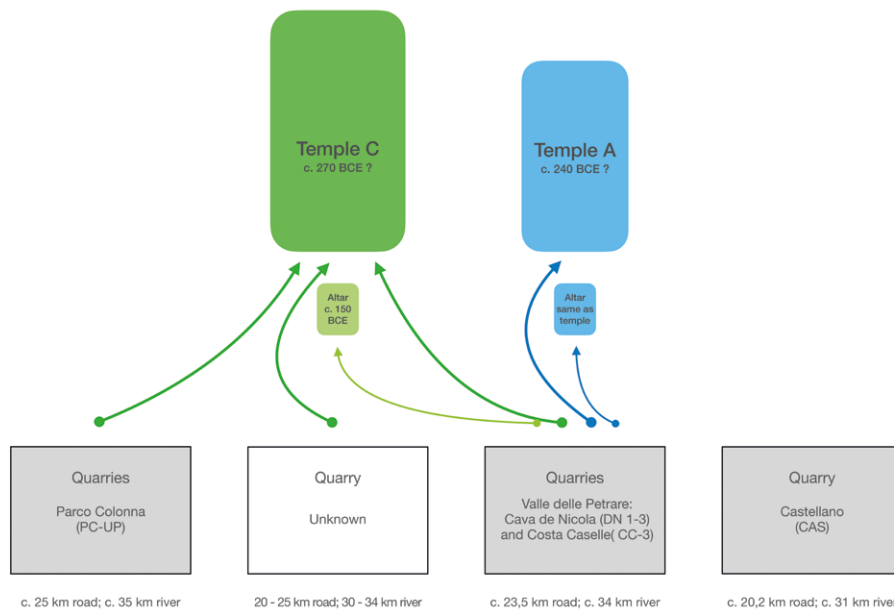


Fig. 6: Schematic overview on the results of this study. A uniform extraction zone was used for Temple A and its altar, while Temple C deployed material from three different sites

6

refer to this as Valle delle Petrare, or just Petrare. The second, for now comprising only sample CC-3, represents the outer slope of the Alban crater, above the Valle delle Petrare, in the Costa Caselle area, where only ancient quarries are attested¹⁷; we will call this Costa Caselle. Samples from the distal ends of the Lapis Albanus deposit, on the crater rim above Costa Caselle (CC-1) and at Castellano (CAS), plot far from all the archaeological samples¹⁸.

10 All Lapis Albanus fragments from the columns of Temple A as well as its altar belong to a rather homogeneous group that most closely matches the Valle delle Petrare field (Fig. 6). Remarkably, this also applies to the altar in front of Temple C. The columnar fragments from Temple C, however, are much less geochemically homogenous. Some samples (from AA 961 and 1495) have trace-element composition similar to those from Temple A, most like the Valle delle Petrare; other samples (from AA 1454, 1494, 2160) define a field that includes Costa Caselle; the sample from AA 961 plots far from the other archaeological samples. Overall, in matching quarries and contextualized column fragments we are now able to identify two areas of Lapis Albanus extraction that were active during the Mid-Republican period.

11 When examining the specific architectural use of these materials, it appears that no single quarry was systematically used for any specific part of a column. Conversely, the change from utilizing multiple quarry areas at Temple C to a single quarry at Temple A prompts us to reflect on distribution models and potential changes in acquisition strategies. In this context, it is imperative to touch upon the contested topics of construction dates, attributions, and building patrons of Temples A and C. Although the sources are far from conclusive, the new data from Largo Argentina enriches the discussion on aristocratic building practices in Rome with new questions.

17 Angle – Cerino 2011; Angle et al. 2014 a; Angle et al. 2014 b. It should be noted that this area does not extend to the crater rim, where the trace-element composition is rather different (sample CC-1).

18 Although the results are not directly comparable, these two distal samples are also outliers with respect to the Lapis Albanus samples from Sant’Omobono analyzed in Diffendale et al. 2019; that is, they would be outliers even accounting for potential instrumental drift.

The Samples

¹² This study relies on seventeen samples of Lapis Albanus taken from architectural elements at Largo Argentina, as well as seven samples from quarry sites and outcrops in the Valle delle Petrare and its immediate surroundings, located below the modern town of Marino in Lazio, some 23 km southeast of Rome, where Lapis Albanus tuff crops out to the surface (Fig. 2). It should be noted that the region around the Valle delle Petrare is the only area where the Lapis Albanus used in Rome was extracted¹⁹. During the 20th century quarrying activity still took place on quarry faces already exploited in antiquity, as can be estimated from photographs by Parker in the 1870s and Ashby in the 1890s. Traces of ancient quarries, however, extend beyond the western and eastern limits of modern exploitation, visible in part along the modern Via dei Laghi as well as in the upper Valle delle Petrare, in the modern Parco della Rimembranza/Barco Colonna. Recent rescue excavations have also exposed ancient quarries at the Costa Caselle site, ca. 100–400 m south of Parco Colonna²⁰. The goal of this study was to localize the building material from Largo Argentina to any of these extraction zones. The seven outcrop samples were collected to provide a reference dataset of natural compositions for the Lapis Albanus cropping out along the Petrare Valley (Fig. 2. 7). Three samples (DN-1, DN-2, DN-3) were collected at different elevations along a single vertical section in the De Nicola quarry, located in the middle of the Valle delle Petrare (Fig. 3); although these come from a single quarry, they should be understood as representative of the central Valle delle Petrare, where numerous modern quarries were in operation until the second half of the last century²¹. One sample (PC-UP) was collected in the Barco Colonna. Two samples were collected southeast of the Valle delle Petrare at Costa Caselle, one at the top of the Albano crater rim (CC-1) and one at its base (CC-3). Sample CC-3 was collected from the site of an ancient quarry, though the quarry itself had been built over before we could sample it; we took the sample instead from a roughed-out but unfinished ashlar block preserved on the worksite, which is unlikely to have traveled far from the quarry face. Finally, one sample (CAS) was collected from a distal deposit located at the western extreme of the outcropping area of Lapis Albanus at loc. Castellano.

¹³ At Largo Argentina in Rome, an elaborate investigation to clarify both the attribution and the context of the architectural members preceded the sample collection, as synthesized in Fig. 5. The sampling was restricted to fragments that were attributed and re-contextualized on the basis of measurements and architectural details. Nevertheless, the samples come from all main parts of a column, meaning the column base, the shaft, and the capital. Eight samples were taken from the columnar fragments of Temple A and six from those of Temple C. The altars were both sampled from architectural parts that were still in situ. In the case of the altar of Temple A, one sample was taken from the base slab (ALT-A), which is the only extant piece. Since the altar of Temple C is almost entirely preserved and in perfect condition, we took a sample from the base (ALT-C2) and another from one of the upper crowning blocks (ALT-C1).

¹⁹ An outcrop of Lapis Albanus further to the southwest, in the area of modern Albano Laziale, is characterized by much larger inclusions not found in the building materials used in Rome, and it appears to have been employed only in very local structures. Therefore, it can be ruled out *a priori*.

²⁰ Angle – Cerino 2011; Angle et al. 2014 a; Angle et al. 2014 b.

²¹ We would like to thank the proprietors of this quarry, Sandro and Franco De Nicola, for their help in obtaining these samples. The Cava De Nicola is the only quarry at Marino still in use, although extraction is not currently practiced.

Methods of Scientific Analysis

Geochemical Analyses

14 The twenty-four bulk samples of the volcanic rock, each approximately 10 cm³ in size, were analyzed for major and trace element composition by Activation Laboratories, Ontario, Canada using Lithium Metaborate/Tetraborate Fusion ICP-M. The fused sample was diluted and analyzed by Perkin Elmer Sciex ELAN 6000, 6100 or 9000 ICP/MS. Three blanks and five controls (three before sample group and two after) were analyzed per group of samples. Wet chemical techniques were used to measure the loss on ignition (LOI) at 900°C. International rock standards were applied for calibration and precision was better than 5% for Rb and Sr, 10% for Ni, Zr, Nb, Ba, Ce, and La, and 15% for the other elements. Full geochemical data is provided as Supplementary Online Material #1²², while the ratios of selected trace elements used in the discrimination diagrams are reported in Supplementary Table (S)1.

Trace Element Discriminating Diagrams

15 Work published in recent decades has provided a large geochemical reference database for the volcanic districts of Italy²³. It demonstrates that the relative abundance of selected trace elements, determined by means of X-ray fluorescence spectroscopy (XRF) and laser ablation inductively coupled plasma mass spectrometry (LS-ICP-MS), may represent a geochemical signature capable of discriminating among different volcanic districts. Building on this idea and focusing on selected "immobile" trace elements and compounds (e.g., Zr, Nb, Y, Th, Ta, TiO₂), which are considered substantially unaffected by alteration processes²⁴, recent work has successfully applied trace-element analysis to the study of volcanic materials used in ancient Roman masonry²⁵.

16 While the measured absolute values of each element may vary as a function of the heterogeneous distribution of different compositional elements (e.g., juvenile scoriae, vitric/zeolitized matrix, loose crystals, lithic inclusions, etc.) within the pyroclastic deposit, their normalization by use of mutual ratios (e.g., Zr/Y, Nb/Y, Nb/Zr, etc.) provides stable values, characteristic of the original magma composition²⁶.

17 Marra et al.²⁷ tested the possible occurrence of a geochemical signature characterizing different outcrop areas of the Tufo Lionato pyroclastic-flow deposit²⁸ as a function of the differing temporal range of emplacement and the consequent different portions of the original magma involved, allowing a distinction within the products of the same eruption. D'Ambrosio et al. employed the same methodology to quarry-provenience Tufo del Palatino²⁹. In the present study, we have applied this principle to identify possible provenience from different quarry sites for another pyroclastic rock, Lapis Albanus.

18 Previous research identified very limited geochemical compositional offsets when the same volcanic rocks are analyzed using different analytical methods (e.g., XRF vs IPC) or at different laboratories³⁰. Small compositional shifts may also occur when

22 Supplementary Online Material #1 can be downloaded here: <https://publications.dainst.org/journals/rm/article/view/4610>.

23 e.g., Peccerillo 2005; Lustrino et al. 2011; Marra et al. 2011; Marra et al. 2014; Peccerillo 2017.

24 Cann 1970; Floyd – Winchester 1975; Duzgoren-Aydin et al. 2002.

25 Lancaster et al. 2010; Marra – D'Ambrosio 2013; D'Ambrosio et al. 2015; Marra et al. 2011; Marra et al. 2013; Marra et al. 2016; Farr et al. 2015; Diffendale et al. 2019; Brocato et al. 2019; Marra et al. 2022; D'Ambrosio et al. 2023.

26 Peccerillo 2017, and references therein.

27 Marra et al. 2018.

28 Freda et al. 1997; Marra et al. 2009, and references therein.

29 D'Ambrosio et al. 2023.

30 Marra – D'Ambrosio 2013.

the same rocks measured at different times by the same laboratory, an effect attributed to "instrumental drift," which can affect laboratory instruments, making periodic recalibration necessary. However, when investigating very small differences in geochemical composition – such as those expected among different outcrops of the same volcanic rock – these analytical uncertainties cannot be ignored. To address these uncertainties, it is best to analyze all samples for a single investigation in a single laboratory batch, as is done in the present study. If results from multiple analyses are to be compared, each analysis should include several specimens from the same samples to enable proper calibration of the results.

Petrographic Analysis

19 A preliminary study using an optical microscope on five volcanic rock outcrop samples (DN-1, DN-2, DN-3, PC-UP, CAS) was also performed. It aimed at highlighting textural and mineralogical variations as a function of the stratigraphical height in the deposit and the distance from the vent.

Geochemical Results

Discriminating Diagrams

20 The results of the geochemical analysis are plotted in the Zr/Y vs Nb/Y, Zr/TiO₂ vs Nb/TiO₂, and Th/Ta vs Nb/Zr discriminating diagrams to verify the different compositions associated with the two temples and their altars, and to compare them with those from the rock outcrops. Full-scale diagrams are provided as insets, while enlarged sections are included to facilitate visualization of the results (Fig. 7).

21 The full-scale diagrams show that two samples of natural outcrops (CAS, CC-1) have a very different composition from all the other samples analyzed. In fact, these are two distal Lapis Albanus deposits, peripheral with respect to the central quarry area in the Valle delle Petrare (Fig. 2). Even in macroscopic appearance, these deposits seem different (see petrography section below), so it is not surprising that they have distinct trace element compositions. We see instead that all the other outcrop samples and those of the temples have very similar compositions, typical of the Lapis Albanus analyzed in previous work³¹, as expected.

Petrographic Analysis with Optical Microscopy

Sample DN-1 (Marino, Cava de Nicola)

22 This sample was collected in the lowest portion of the pyroclastic-flow deposit exposed by quarry cuts in the Valle delle Petrare (see Fig. 2). It displays a matrix-supported texture with abundant mafic minerals and relatively scarce matrix (i.e. clasts almost in contact). The latter is made up almost completely of zeolites and calcite. The mafic minerals in the matrix are diopsidic clinopyroxene, with golden, green-olive color that indicates enrichment in Fe³⁺ and Al, phlogopite and granditic garnet, probably enriched in Ti (Fig. 9 a). The juvenile fraction is represented by poorly vesicular scoria clasts with clinopyroxene, phlogopite, amphibole (Fig. 9 b), garnet, and magnetite phenocrysts and a groundmass where leucite and glass are totally turned into zeolites. Noteworthy are

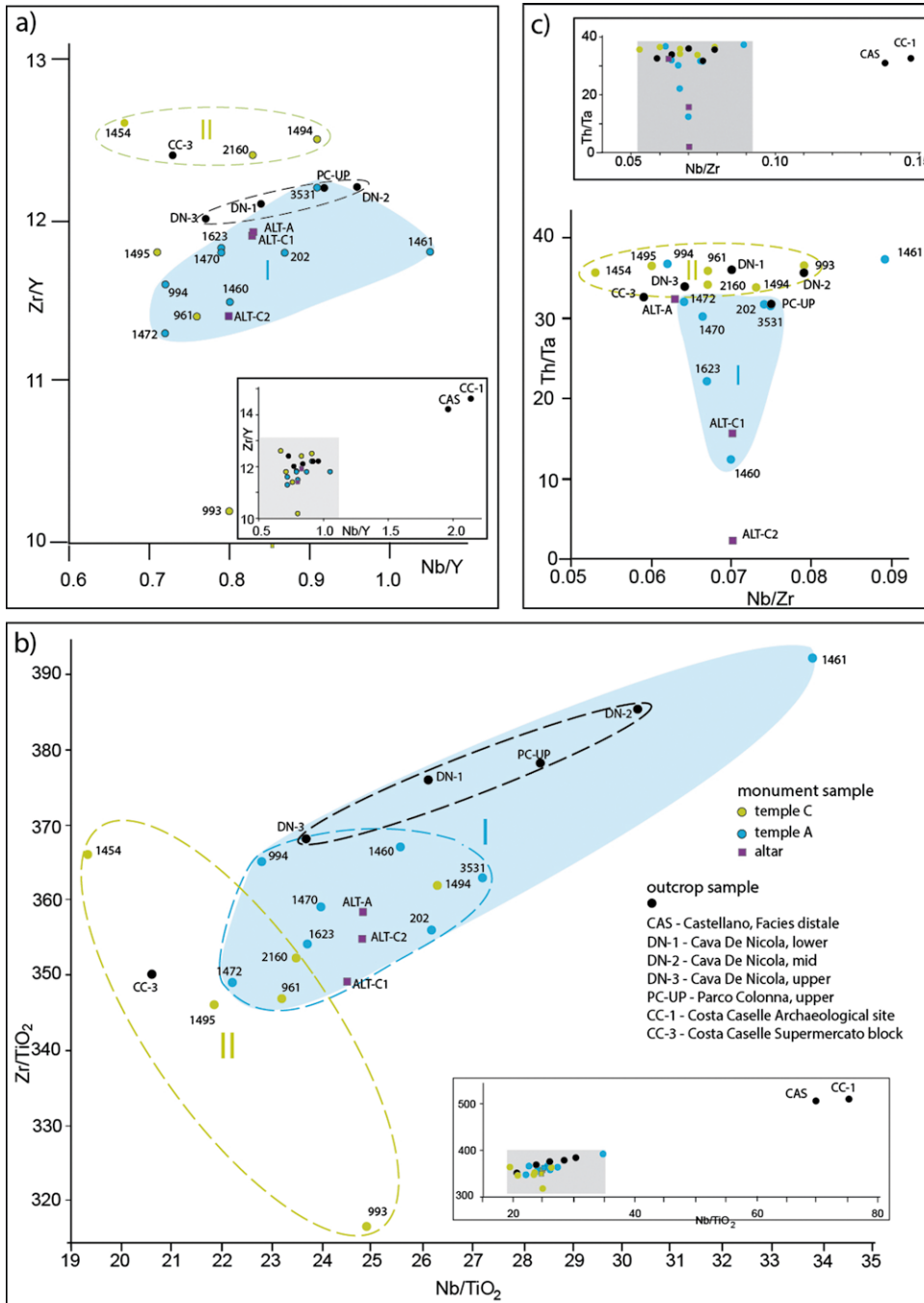


Fig. 7: Trace element diagrams (a: Zr/Y vs. Nb/Y, b: Zr/TiO₂ vs. Nb/TiO₂, c: Th/Ta vs. Nb/Zr). The insets show the full-scale graphics; the area with a gray background is enlarged to better visualize the distribution fields and to distinguish the symbols of the samples

7

the amphibole phenocrysts – very rare in the Colli Albani scoria clasts³² – that represent a distinctive feature of the Lapis Albanus.

Sample DN-2 (Marino, Cava de Nicola)

23 This sample was collected ca. 2 m above DN-1, in the middle of the pyroclastic-flow deposit. The texture is similar to DN-1 with a faintly clast-supported texture rich in mafic minerals. However, this sample is characterized by the occurrence of large subeuhedral to anhedral leucite crystals (Fig. 9 c) and glassy scoria clasts.

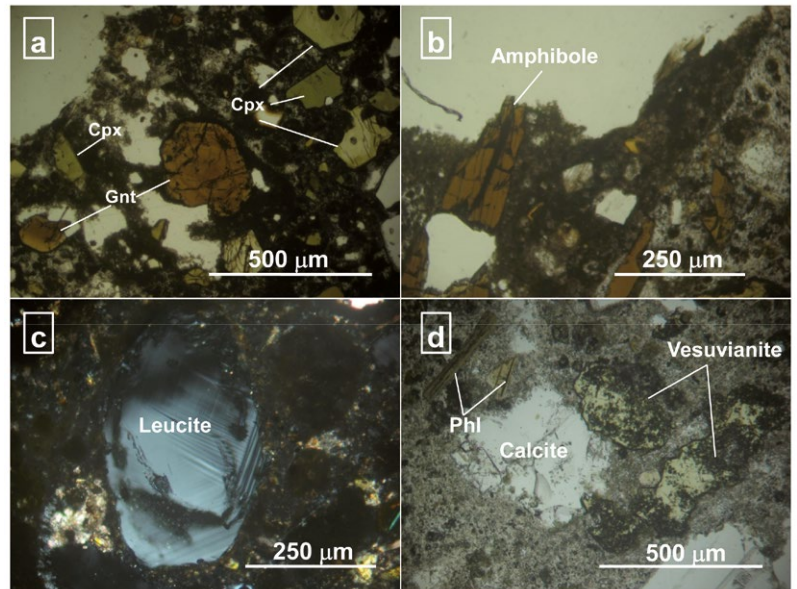
32 e.g., Gaeta et al. 2021.

Fig. 8: Selected trace-element composition of analyzed samples. Blue: Temple A; green: Temple C; mauve: altars of A and C; black: natural outcrop

Sample	Y	Zr	Nb	TiO ₂	Th	Ta	Zr/Y	Nb/Y	Zr/TiO ₂	Nb/TiO ₂	Nb/Zr	Th/Ta
AA 202	23	272	20	0,764	31,6	1	11.8	0.87	356	26.2	0.074	31.6
AA 993	25	254	20	0,802	33	0,9	10.2	0.80	317	24.9	0.079	36.7
AA 994	25	289	18	0,791	29,4	0,8	11.6	0.72	365	22.8	0.062	36.8
AA 961	25	284	19	0,819	32,3	0,9	11.4	0.76	347	23.2	0.067	35.9
AA 1454	21	265	14	0,725	24,9	0,7	12.6	0.67	366	19.3	0.053	35.6
AA 1460	25	287	20	0,781	31,1	2,5	11.5	0.80	367	25.6	0.070	12.4
AA 1461	21	248	22	0,632	33,6	0,9	11.8	1.05	392	34.8	0.089	37.3
AA 1470	24	284	19	0,791	30	1	11.8	0.79	359	24.0	0.067	30.0
AA 1472	25	283	18	0,811	28,8	0,9	11.3	0.72	349	22.2	0.064	32.0
AA 1494	22	275	20	0,76	30,3	0,9	12.5	0.91	362	26.3	0.073	33.7
AA 1495	24	282	17	0,816	29,1	0,8	11.8	0.71	346	20.8	0.060	36.4
AA 1623	24	284	19	0,803	28,7	1,3	11.8	0.79	354	23.7	0.067	22.1
AA 2160	23	285	19	0,809	30,6	0,9	12.4	0.83	352	23.5	0.067	34.0
AA 3531	23	280	21	0,772	31,5	1	12.2	0.91	363	27.2	0.075	31.5
ALT-A	23	274	19	0,766	29,3	0,9	11.9	0.83	358	24.8	0.063	32.5
ALT-C2	25	286	20	0,805	33,4	14,8	11.4	0.80	355	24.8	0.070	2.3
ALT-C1	24	285	20	0,816	32,3	2,1	11.9	0.83	349	24.5	0.070	15.4
CAS	24	341	47	0,669	57,7	1,8	14.2	1.96	510	70.2	0.138	32.1
DN-1	25	302	21	0,804	32,5	0,9	12.1	0.84	376	26.1	0.070	36.1
DN-2	25	305	24	0,793	35,8	1	12.2	0.96	385	30.3	0.079	35.8
DN-3	26	311	20	0,845	30,5	0,9	12.0	0.77	368	23.7	0.064	33.9
PC-UP	25	306	23	0,81	34,9	1,1	12.2	0.92	378	28.4	0.075	31.7
CC-1	21	306	45	0,596	55,8	1,7	14.6	2.14	513	75.5	0.147	32.8
CC-3	26	322	19	0,921	30,2	0,9	12.4	0.73	350	20.6	0.059	33.6

Sample DN-3 (Marino, Cava de Nicola)

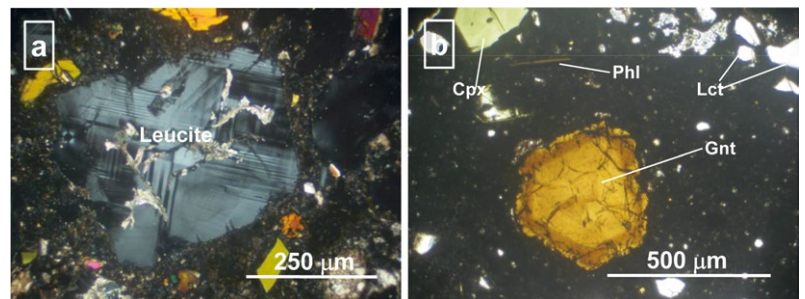
24 This sample was collected at ca. 5 m, in the middle-upper portion of the pyroclastic-flow deposit. The texture is similar to DN-1 and DN-2 with a faintly clast-supported texture rich in mafic minerals. However, in this sample large leucite crystals are lacking, while igneous, metamorphic and sedimentary lithic clasts are abundant. In particular, vesuvianite-bearing skarns (Fig. 9 d) and clinopyroxene cumulates are present. The abundance of mafic minerals and metamorphic and sedimentary lithic clasts indicates that DN-3 had its origin from the peripheral part of the magma chamber, close to the wall rock. According to the stratigraphical position, pyroclastic currents characterized by the enrichment of antecrysts, phenocrysts and lithic clasts signal the final part of explosive eruptions.



9

Sample PC-UP (Parco Colonna)

25 This sample was collected in the eastern part of the Petrare Valley, in the middle-upper portion of the pyroclastic-flow deposit (see Fig. 2). It displays matrix-supported texture with abundant, large leucite crystals (Fig. 10 a) and compositional features quite similar to those of sample DN-2 from the middle part of the pyroclastic-flow deposit at Marino (Fig. 9 c).



10

Sample CAS (Castellano)

26 This sample was collected in the distal western sector of the Petrare Valley (Fig. 2). It displays a fine, matrix-supported texture (ash-flow), with golden, green-olive clinopyroxene, granditic garnet coupled with small leucite and phlogopite crystals (Fig. 10 b). In particular, this sample shows higher leucite and lower clinopyroxene and Ti-magnetite contents with respect to the DN samples. Depletion of mafic minerals indicates a more diluted pyroclastic current, according with the distal position of the CAS outcrop.

Interpretation of the Geochemical and Petrographic Analyses

Zr/Y vs Nb/Y diagram

27 The Zr/Y vs Nb/Y diagram of Fig. 7 a shows that the samples of Temple A (blue dots) have relatively homogeneous compositions (blue shaded area = compositional field I), partly overlapping those of the samples of the Valle delle Petrare quarries (black dots; DN-1 -2 -3 and PC-UP). The latter come from the area corresponding to the central axis of the valley and their compositions describe a very narrow field (black dashed line). It should be noted that the tendency for samples of a pyroclastic rock to plot

Fig. 9: Microphotographs of the Lapis Albanus samples in the optical microscope. Sample DN-1: mafic minerals (Cpx: diopsidic clinopyroxene; Gnt: granditic garnet) in the Lapis Albanus matrix (a) and amphibole phenocryst in the scoria clast (b). Sample DN-2: anhedral leucite crystal in the Lapis Albanus matrix (c, crossed nicols). Sample DN-3: details of the vesuvianite-bearing skarn occurring among the lithic clasts; large zone of spatic clacite and greenish mica are also present (d)

Fig. 10: Microphotographs of the Lapis Albanus samples in the optical microscope. Sample PC-UP: subhedral leucite crystals in the Lapis Albanus matrix (a, crossed nicols). Sample CAS: fine, matrix-supported texture with green-olive clinopyroxene (Cpx), granditic garnet (Gnt) coupled with small leucite (Lct) and phlogopite (Phl) crystals (b)

within narrowly elongated compositional fields, displaying a sub-rectilinear trend, is a distinctive feature of the Zr/Y vs Nb/Y diagram. As discussed elsewhere³³, the elongated trends are a consequence of the fact that the original magma is characterized by a roughly constant Nb/Zr ratio (corresponding to the angular coefficient of the line that averages the trend of the compositional field), whose range of variability is expressed by the horizontal spread of the respective field on the Th/Ta vs Nb/Zr diagram (Fig. 7 c).

28 In contrast, the samples attributed to Temple C (green dots) have less homogeneous and different compositions from those of Temple A, with only one sample (AA 961) plotting within the same compositional field on the Nb/Y vs Zr/Y diagram. They are distributed in part around the compositional field of the samples of Temple A (sample AA 1495, AA 993), while others define a compositional field higher up in the diagram (green dashed line: samples AA 1454, 1494, 2160 = compositional field II). It is interesting to note that the sample from the Costa Caselle extraction zone (CC-3) plots within this same compositional field II.

29 We can infer that the pyroclastic deposit occurring at the bottom of the valley (characterized by compositional field I) was emplaced in the early stages of the eruption, as opposed to that occurring in the higher, lateral parts of the valley, hence the different magma composition between the two source areas. In fact, sample CC-3 is characterized by a higher proportion of trace elements compatible in olivine (Co), clinopyroxene (V) and spinel (Cr), mafic minerals abundant in the oldest products of the Albano maar³⁴, that could have been caught by the pyroclastic current locally.

30 The three samples from the altars plot within the field defined by the column samples attributed to Temple A, and are compatible with an origin from the Valle delle Petrare, with samples ALT-A and ALT-C1 displaying identical composition.

Zr/TiO₂ vs Nb/TiO₂ diagram

31 Similar observations are reiterated in the Zr/TiO₂ vs Nb/TiO₂ diagram of Fig. 7 b, which is a useful control to obviate the fact that the concentrations of Y can vary according to the degree of differentiation of the magma³⁵.

32 In this diagram, we observe that the samples of A and C tend to plot within two compositional fields (shaded blue area and green dashed border line); those of the Valle delle Petrare quarries remain close to those of Temple A and define an even tighter trend (dashed black line). It should be noted that the Valle delle Petrare samples (DN-1 -2 -3) were taken in the same location at different elevations and consistently are characterized by a very steady Nb/Zr ratio, reflecting an extremely homogeneous composition of the magma. Samples from Temple A and the altars align with the trend of these samples, defining a less linear field, which suggests they originated from a nearby, but more extensive area. In contrast, several samples of Temple C define a wide and elongated field (compositional field II) in the opposite direction to that which we would expect for a magma with a homogeneous composition, highlighting their origin from different quarry areas, including but probably not limited to the Valle delle Petrare and Costa Caselle.

33 The third, Th/Ta vs Nb/Zr diagram in Figure 7c is generally less precise in highlighting compositional differences, but offers further insights. It can be noted that here too the two sample groups define distinct compositional fields, with only one sample of Temple A (AA 994) plotting in the field of Temple C and the sample of the altar of Temple A at the boundary between the two compositional fields. However, we see some apparent inconsistencies with respect to the previous diagrams: in particular it seems that the samples of Temple C have compositions more similar to the Valle delle Petrare

33 Marra et al. 2011.

34 Gaeta et al. 2009.

35 Marra et al. 2016.

samples. However, this is due to the fact that some samples of Temple A (1460, 1623) and the two Temple C altar samples had anomalously high Ta values (Fig. 8), which moves them down in the graph. Were it not for this offset, all the samples would have very homogeneous compositions with each other in this diagram. On the other hand, this Ta anomaly affects only the samples of A and the two altar samples, suggesting that this too is a characteristic linked to the site of origin, confirming the homogeneity of these samples and their diversity compared to the column samples of Temple C.

34 The higher Th/Ta ratio of samples from Temple C is indicative of their provenience from portions of the Lapis Albanus enriched with skarn fragments deriving from crustal contamination of the Colli Albani magmas³⁶. CaO-rich melts occurring in the Colli Albani skarn show very high Th/Ta ratio (100–130)³⁷. The relatively high Th/Ta ratio (17) of the interstitial glasses in the Lapis Albanus scoria are produced by a similar AFC (assimilation, fractional crystallization) process³⁸.

From Geochemistry to Construction History

35 Our analysis demonstrates that the seventeen Lapis Albanus tuff fragments from both the columns and altars of Temples A and C come from multiple extraction zones, of which two can be identified as the Valle delle Petrare and Costa Caselle; some elements of Temple C may have been quarried in an as-yet unidentified third extraction zone (Fig. 6).

36 It must be noted that we do not have enough data points to identify specific quarries. Currently, geochemical analysis allows us to distinguish “extraction zones,” which could have hosted multiple quarries (Fig. 11). For example, the Valle delle Petrare extends roughly 2 km from east to west, with an average width of 100 to 150 m, and contained several active quarries until the 20th century. The ancient extraction zone at Costa Caselle has not yet been published in sufficient detail to determine how far the quarries extended. Since our knowledge is derived from rescue archaeology, it is likely that further remains have already been destroyed by previous urban development in the area.

37 Theoretically, at the highest level, we can identify the *quarry landscape*³⁹ as the overall complex of stone extraction activities within the Lapis Albanus deposit. The next level comprises *extraction zones*, which are geochemically-defined sub-deposits within the overall Lapis Albanus formation, representing geological and geographical realities. Below this level, extraction zones might contain multiple *quarries*, which are geographical and administrative entities: individual portions of the extraction zones owned or administered by certain persons, political entities, or corporations. However, we currently lack sufficient geochemical, archaeological, historical, or epigraphic data to distinguish these for the Roman period. Each quarry could further be subdivided into different *quarry faces* or *extraction areas*.

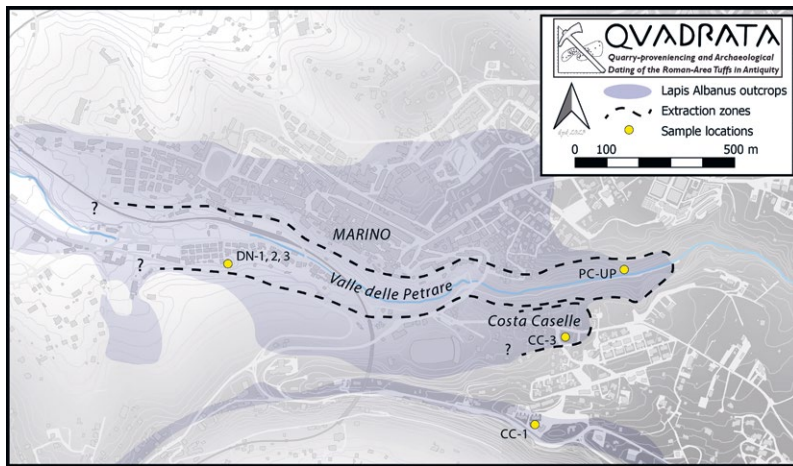
38 The extraction zones are located near each other, with the center of Costa Caselle only 150 m above the nearest part of the Valle delle Petrare, and both are close to the stream running at the bottom of the valley (Fig. 2. 11). The samples from the two distal outcrops, CC-1 on the crater rim and CAS at Castellano, located over 2 km from the western end of the Valle delle Petrare, at the end of the Lapis Albanus deposit, did not clearly match the material from Largo Argentina and can therefore be excluded from the following discussion. Furthermore we have seen that the material from Temple A and its altar is compatible

36 Di Rocco et al. 2012.

37 Gaeta et al. 2009.

38 Gaeta et al. 2011.

39 Heldal – Bloxam 2008.



11

Fig. 11: Proposed extraction zones of Lapis Albanus at Marino

some interpretative models on how the data from Largo Argentina might inform – or fail to inform – our understanding of both quarry exploitation and the construction process. Finally, we aim to address potential stakeholders involved in these activities, including some leading aristocratic families of Republican Rome.

Stone Characteristics and Architectural Use

From a constructional viewpoint, it is evident that structural capacity was the decisive criterion for both selecting and specifically using certain types of tuff⁴¹. For example, the Mid-Republican Temple A utilized not only Lapis Albanus tuff. Tufo Giallo della Via Tiberina (so-called “Grotta Oscura”) was used for the inner core of the podium foundations, the brownish Tufo Lionato (Anio facies) for the outer cladding of the podium, Tufo Rosso a Scorie Nere (“Fidenae”) for the ashlar masonry of the cella walls, and finally, Lapis Albanus for the columns, exterior revetments/moldings of the cella, stone parts of the entablature, as well as the staircase and altar⁴². This differentiation depended on the compactness and density of the various materials.

At the time, Lapis Albanus was the most compact material available, making it ideal for load-bearing columns and intricate complex carving; however, these same qualities made it more difficult to cut and transport, particularly as the quarries were distant from major rivers⁴³. The evidence from Largo Argentina offers an opportunity to consider whether there was further quality differentiation within a given material category. In other words, were some Lapis Albanus quarries considered more suitable for complex architectural elements such as bases or columnar capitals? A caveat is that, as previously noted, the data generally do not allow us to pinpoint specific quarries, but only larger areas of extraction that may contain multiple quarries.

Since Temple A exclusively employed material from the Valle delle Petrare, we must turn to Temple C to explore correlations between extraction zones and architectural use. For all parts of the columns of Temple C, the geochemical analysis revealed samples that were both within and outside the principal clusters of the two extraction zones (Fig. 7). This indicates that, based on the data we have, there is no evidence to suggest that a particular quarry was used for a specific architectural member.

with extraction from a limited area within the Valle delle Petrare, whereas the material from Temple C shows compatibility with the Valle delle Petrare, Costa Caselle, and potentially a third, unknown area. Notably however, the later altar of Temple C was still cut from Valle delle Petrare tuff.

39 Interpreting the quarry patterns revealed by our analysis is challenging, especially given the limited knowledge about quarry organization during the Republican period due to the lack of written evidence, both historical and epigraphical⁴⁰, and this situation does not improve for the Empire. In the following sections, we offer

40 See, in brief, Bernard 2018, 40 f.

41 Jackson et al. 2005.

42 Marra et al. 2018; Zink et al. 2020.

43 See, however, Arietti 2010 for evidence of the ancient navigability of one of the watercourses that originated at Tusculum, which could have served for stone transport from the Lapis Albanus quarries.

43 In this context, it is also interesting to note the overlaps between Temples C and A – specifically, the architectural elements of Temple C that appear to have the same source as those used for Temple A. According to the primary Zr/Y vs. Nb/Y diagram, this applies to the column base fragment AA 961 and, potentially, the capital fragment AA 1495. However, there is evidence of using other quarry sources for the same type of architectural members, such as base AA 2160 and capitals AA 1454 and AA 1494. All this suggests that there was no systematic relationship between a specific quarry and an architectural part such as the column bases, drums, or capitals. A further caveat is that the original locations of the fragments within the overall building structure are unknown; our graphically reconstructed columns represent a random selection of pieces that belong to the same type due to their measurements, but they may not originate from the same column. Theoretically, higher quality stone might have been reserved for the most visible columns of the temple's frontal façade⁴⁴. In Temple C, for example, the base and capital fragments in Valle delle Petrare tuff could have been employed only for the frontal columns.

44 Conversely, the clustering of the three altar samples, particularly the near-identical composition of two samples from different altars, might suggest that a specific quarry (or a particular quarry face) within the central Petrare Valley was selected for this type of monument. Altars required a particularly fine grain and a low frequency of inclusions, especially when they were to be inscribed, as in the case of Altar C featuring the inscription of Postumius (Alt-C1)⁴⁵. According to a recent claim, both altars could have been a project by Postumius, and the geochemical similarities between them may further support this theory, which nevertheless remains seriously challenged by other data⁴⁶.

45 Overall, we cannot pinpoint any systematic use of a specific extraction zone or quarry for the columns of Temple C. Rather, it appears that the quarry composition of C varied from column to column and even from architectural member to architectural member, unless there was a differentiation between frontal and lateral columns that now escapes us, because of the limited samples at our disposal. Ultimately, the only consistent pattern of quarry choice that we can actually state is the systematic use of material from the Valle delle Petrare for all parts of the columns of Temple A and its altar.

Construction Dates and Attributions

46 Before further exploring the implications of the distribution patterns that evolve from our research, we must consider the construction dates and attributions of the temples. Currently, there are two primary lines of evidence for these aspects, although neither is entirely conclusive. From an archaeological and stylistic standpoint, the shape of the architectural moldings of the temple podia suggests a date around the second half of the 3rd century BCE, with those of Temple C perhaps being slightly ear-

44 Compare the central Temple at S. Nicola in Carcere, which in its early 1st century BCE phase employed travertine at the front and back and Lapis Albanus along the less visible sides. Later temples would use marble columns at the front and travertine and/or brickwork along the sides (e.g. Temple of Apollo Sosianus, 20s BCE, posterior angular columns in travertine and engaged half columns in brickwork; see Viscogliosi 1996, 40).

45 Although mid-Republican molded monuments, including altars, from the nearby twin temples at Sant'Omobono were analyzed in previous work (Diffendale et al. 2019), they unfortunately cannot be directly compared with the present results, due to the problem of instrumental drift described above. In future studies, control samples should be included to allow for the possibility of correction and inter-study comparison.

46 In support of the earliest altar of Temple A as part of Postumius' renewal project of 142 BCE, scholars have cited the similarity of their moldings, the flat cyma reversa, which was assumed to be a 2nd century BCE phenomenon (Coarelli 2014, 136 f., Cavallero 2018, 41). This argument is based on Shoe 1965, 30. 94 f. 153. 159 f. who in turn references Marchetti-Longhi's erroneous phasing of Temple A and consequently dates the earliest altar of Temple A to the 2nd century BCE (*contra* Zink et al. 2020, 391–399). However, surface traces indicating the long use of the first altar in front of Temple A, such as weathering and a repair-clamp, support the contemporaneity with the temple's earliest phase (c. 240 BCE). These characteristics contrast with the almost newly finished surfaces of Postumius' altar, which had a very short period of use due to a catastrophic flood causing construction phase 2 (Zink et al. 2020, 401; Ceci 2020, 80 f.). Additionally, there is an absence of renewal signs in the pavement around the altar of Temple A, and the flat cyma reversa also appears on the podium of the earliest phase of Temple A (ca. 240 BCE according to the phasing of Zink et al. 2020; Ceci 2020, 81; Kudryashova 2021).

lier⁴⁷. Additionally, the newly reconstructed Italic-Ionic capitals from Temple A can now be included in this analysis, as they are comparable to a capital from Tarquinia dated to the 3rd century BCE⁴⁸. The literary-historical perspective depends on identifying each structure with temples dedicated to specific divinities mentioned in ancient sources.

⁴⁷ Without delving into a detailed discussion, the prevailing view among scholars follows Coarelli's identification of Temple A as the temple of Juturna, a local water nymph⁴⁹. According to the Vergil commentator Servius⁵⁰, the consul Gaius Lutatius Catulus was the first to dedicate a temple to Juturna in the Campus Martius. The temple was likely connected to his victory over Carthage at the Aegates Islands in 241 BCE, which earned him a triumph, bringing an end to the First Punic War⁵¹.

⁴⁸ The other important source for identifying Temple A is Ovid's *Fasti*, which mentions a temple of Juturna in the Campus Martius, usually interpreted as being related to the course of the Aqua Virgo aqueduct⁵². Some scholars understand Ovid's use of *obitur* to mean where the aqueduct terminated, about 300 m north of Largo Argentina, near the Pantheon, and argue that this location is too far away to be related to Largo Argentina⁵³. Heyworth argues that *obitur* cannot mean 'terminate' but rather 'cross' or 'traverse', and locates the temple of Juturna somewhere along the aqueduct's arched course across the Campus Martius, which is also far from Largo Argentina⁵⁴.

⁴⁹ No commentator, however, seems to consider that *Virginea... aqua* need not refer to the visible infrastructure of the aqueduct itself⁵⁵. Thanks to Frontinus, we know that the Virgo supplied the Euripus channel in the Campus Martius, contributing a fifth of its total capacity⁵⁶, feeding first the *Stagnum Agrippae* which then flowed into the Euripus⁵⁷. In fact, Frontinus mentions that the Virgo *Euripo... ipsa nomen dedit*; as Rodgers comments, the phrase "means that this *euripus* was called *euripus aquae Virginis*, or possibly just 'Virgo'"⁵⁸. An Ovidian understanding of this association is further suggested by *Pont.* 1.8.38–39, *stagna et euripi Virgineusque liquor*⁵⁹. In the light of this, Ovid's phrase, "where the Campus [Martius] is traversed (or wandered through) by the Virgin's water," can be better understood to mean the entire trajectory, from where the aqueduct's arches crossed the Via Flaminia, descended underground by the Saepta, to then feed the baths and stagnum of Agrippa, flowing out through the Euripus to eventually reach the Tiber. This interpretation removes the need to locate Juturna northeast of the Saepta.

⁵⁰ Thus, the most convincing hypothesis remains Coarelli's, linking the water goddess with Temple A and the adjacent Agrippan complex⁶⁰. Additionally, it should be noted that water played a crucial role at the site of Largo Argentina from the very beginning. Recent research indicates that, during the 3rd century BCE, the area of Largo Argentina was surrounded by small creeks and waterways, with regular floods from the

⁴⁷ Shoe 1965, 22 f. 146; Edlund-Berry 2008, 445.

⁴⁸ See Zink et al. forthcoming.

⁴⁹ Coarelli 1981; De Stefano 2012, 543; Davies 2017, 53; Zink et al. 2020; Palombi 2020, 322 f. (in particular tables 4, 5); more skeptically Bernard 2018, 5–11.

⁵⁰ Serv. 12.139.

⁵¹ Fast. Tr.; Val. Max. 2.8.2.

⁵² Ovid, *Fasti*, 1.463–4: *te quoque lux eadem, Turni soror, aede recepit, hic ubi Virginea Campus obitur aqua*.

⁵³ Kondratieff 2008; Bernard 2018, 9.

⁵⁴ Heyworth 2011, 47 f.

⁵⁵ We moderns are used to reading *Aqua Appia*, *Aqua Virgo*, etc. as aqueducts, but we must not forget that *aqua* means, of course, first and foremost 'water'.

⁵⁶ Frontinus, *Aq.* 84.

⁵⁷ Coarelli 1977; Scaroina 2006.

⁵⁸ Frontinus *Aq.* 84.3; Rodgers 2004 ad loc.

⁵⁹ Martial's (5.20.9) association is vaguer (*Campus, porticus, umbra, Virgo, thermae*), but reinforces the idea of a suffusion of the Campus Martius by the waters of the Virgo.

⁶⁰ Coarelli 1981, 42 f.; Coarelli 1997, 247–250.

nearby Tiber River being a persistent issue throughout antiquity and beyond⁶¹. Therefore, we prefer to adhere to the interpretation of Temple A as Gaius Lutatius Catulus' temple of Juturna, constructed following the victory of 241 BCE, and probably dedicated during the earlier part of the 230s BCE.

51 Temple C has frequently been identified as dedicated to the Sabine goddess Feronia⁶². There is no surviving ancient source explicitly mentioning the temple's dedication; it should therefore be placed during the period for which the text of Livy – otherwise an assiduous recorder of temple foundations – is missing, 293–218 BCE. Shortly after Livy's narrative resumes with the events of 217 BCE, he records offerings made to Feronia, which implies the temple's prior existence⁶³.

52 The Sabine origin of the goddess Feronia suggests that the temple's foundation is linked to Roman activities in Sabine territory. In 290 BCE, Manius Curius Dentatus was granted a double triumph for a victory over the Samnites and Sabines⁶⁴, marking the definitive integration of the Sabina into Roman control. Coarelli attributes the introduction of Feronia to Rome to Dentatus⁶⁵. Curius Dentatus remained active in the area in 272 BCE, during his censorship, when he dedicated the Anio Vetus aqueduct, originating at Trevi del Lazio in Sabine territory. This aqueduct was funded by spoils from his victory over Pyrrhus and Tarentum, which might also have financed the construction of the Temple of Feronia, though this remains speculative. This would, however, represent a rather lengthy gap between vow and dedication; however, long intervals were not unprecedented, with the longest known being 17 years for the Temple of Honos et Virtus, while intervals of two to four years were more common⁶⁶.

53 If the identification of Temple C as Dentatus' Temple of Feronia and Temple A as Catulus' Temple of Juturna is correct, then about three decades separate the construction of Temple C (ca. 270 BCE) from Temple A (ca. 240 BCE). Like many temples in Rome at the time, Temples A and C would have been manubial temples, financed from the spoils of war. They served as visible testimonies to expanding Roman power during the 3rd century BCE, with Temple C commemorating Rome's final hegemony over Southern Italy and Temple A marking territorial control over Sicily, Sardinia, and Corsica.

Potential Stakeholders and Distribution Scenarios

54 Returning to the use of Lapis Albanus at Largo Argentina, we can now ask what it means that Temple C drew upon heterogeneous quarries while Temple A, built about three decades later, relied on a more homogenous source. With regards to Temple C, four scenarios are possible when it comes to the transaction between stone suppliers and the building contractors (*redemptores*) who actually carried out the construction at the site:

61 Ceci et al. 2018.

62 Castagnoli 1948; Coarelli 1981, 14 f. 37. 40–42; Coarelli 1996 d; Coarelli 1997, 197–209; Davies 2017, 53 f.; D'Alessio 2012, 499; De Stefano 2012, 542; Moser 2019, 62 f.; Palombi 2020, 322 f. (tables 4. 5); *contra* Ziolkowski 1992, 25–28, who argues that Temple C should be identified as the temple of Feronia due to the presence of a series of water basins. However, these basins are of Late Republican or even Augustan date, as Ceci et al. 2019 have shown, and they are therefore not an argument for attributing the temple to the water deity Feronia; Bernard 2018, 9 is skeptically agnostic.

63 Liv. 22, 1, 15–18.

64 Liv. *Periochae* 11, 6.

65 Coarelli 1981, 40–42; Coarelli 1997, 197 f. The involvement of a Curius – likely of Sabine origin: Coarelli 1997, 208 f – in the conquest of the Sabina would be an example of the sorts of family agendas described in Terrenato 2019.

66 Orlin 1997, 154. 158. 170.

1. A single quarry contractor exploited multiple quarries and sold the stone to a single building contractor (*redemptor*) who deployed them for the columns of Temple C;
2. A single *redemptor* purchased the stone from multiple quarry contractors or stone vendors who each had access to a different quarry;
3. A single *redemptor* contracted to exploit stone from several areas of an extensive system of public quarries;
4. Several *redemptores* were engaged for the construction of the Temple A, and each had access to a different quarry source. In this scenario, a *redemptor* could have carried out one or several columns.

55 Another, at least theoretical possibility, is that the Lapis Albanus used in Temple C was recycled material from multiple earlier projects. However, we found no traces of reuse on any of the architectural elements, which allows us to exclude this possibility. Moreover, based on our current state of knowledge, there were not many earlier projects from which such stone could have been reused. Even though the first importation of Lapis Albanus to Rome can be dated to the end of the 6th century BCE, it does not appear to have been commonly used until the 3rd century BCE⁶⁷.

56 We could also ponder the existence of a stoneyard, similar to the hypothesized Imperial *marmorata*, where stones from multiple sources were aggregated and redistributed⁶⁸. However, even for the Imperial period, epigraphical sources are ambiguous, and B. Russell has demonstrated that archaeological evidence does not support the existence of intentional stockpiles⁶⁹. In contrast, for the Augustan period – and very likely reflecting Republican practices – Vitruvius recommended that newly-quarried tuff be seasoned for a period of two years by exposing it to the elements; stone that passes this test can be used above ground, while stone that fails can be relegated to foundations⁷⁰. Yet, evidence is lacking on how this process would have worked in practice. For instance, it is unclear where the curing process took place: at or near the quarry, in urban stoneyards, or at some intermediate location?

The Roman Gentes as Building Patrons

57 Looking at the other side of the transaction, members of the Roman aristocracy emerge as potential building patrons of Temples A and C. However, starting from 304 BCE with the Lex Papiria, the Senate was required to grant permission for the construction of any temple, including victory temples. Although the vower/dedicator of the temple was responsible for its planning and execution, public involvement, including financing, was also possible at this stage, as demonstrated by Eric M. Orlin in his survey of so-called manubial temples⁷¹. While the line between private and public sponsorship often remained blurred, constructing a temple – and the public display of both piety and service to the state’s interest – undoubtedly enhanced the glory of the dedicator and his entire gens. These aristocratic families would be involved in the design, repair, maintenance, and rebuilding of the temples, even for generations later⁷².

67 See above notes 9 and 10.

68 Fant 1993; Hirt 2010, 342–351.

69 Russell 2013, 232–239; see Pensabene 2015 responding to Russell and expressing measured support for the existence of a central Imperial authority in the stone trade. Even if one does accept such an aggregation site, the Emporium only began to be developed during the 2nd century BCE; prior to this the main harbor would have been at the Forum Boarium: Maischberger 1997, 61–66.

70 Vitr. 2.7.5; the same recommendation in Pliny (HN 36.50.170) is probably taken from Vitruvius. See Bernard 2018, 194–197 for Vitruvius’ debt to Republican traditions of stonemasonry. “Curing” or “seasoning” freshly-quarried stone to remove the “quarry sap” (moisture) is a well-known practice even among modern stonecutters.

71 Orlin 1997, 127–139. 159. 165–167 (Lex Papiria); 190 f.

72 On *gloria* in relation to Temple Building, see Orlin 1997, 67–69. 161 f. 192 f.; on family connections Id.

In the case of the Catuli, the family likely responsible for dedicating Temple A, we see how an aristocratic family maintained and even expanded their building heritage at the site of Largo Argentina. In 101 BCE, Quintus Lutatius Catulus, a descendant of Gaius, who initially dedicated Temple A in 241 BCE, vowed another victory temple during the battle of Vercellae against the Cimbri, an invading Gallic tribe in northern Italy. Fittingly, this temple was dedicated to the goddess Fortuna Huiusce Diei, the fortune of that specific day on which Fortuna granted him victory (Plut. *Mar.* 25–26). It is our fortune that the identification of Temple B at Largo Argentina as Catulus' temple is relatively straightforward. The construction of Temple B points towards the turn of the 2nd to the 1st century BCE, and the literary evidence indicates that Catulus' temple had a rare round plan and was located in the southern Campus Martius (Varro *Rust.* 3.5.12)⁷³.

58 It is evident that the construction not only of temples but public infrastructure in general was a regular and significant part of the business activities of the Roman Republican elite. The fact that Gaius was able to source stone for Temple A from a single quarry site raises the hypothesis that the Catuli might have become owners of a quarry in the Valle delle Petrare. Certainly, the revenues from the victory over Carthage could have enabled Gaius to make such an investment. Unfortunately, we lack information about his later career and building activities, and the Catuli are not epigraphically attested in the Valle delle Petrare. Moreover, there is no evidence to link any quarry around Rome to a specific *gens*. Regardless, the fact that in about 240 BCE it was possible to use a single quarry source for Temple A may also suggest increased extraction capacity, allowing one provider to supply all material needed for the columns of a single construction site.

59 For Temple C, we lack information regarding any subsequent building interventions by the *gens Curia*, the family that was probably responsible for its initial construction. Regarding the altar, its inscription informs us that the dedication was connected to the *Lex Plaetoria*, a special law that appointed an Aulus Postumius Albinus as a *duumvir* (along with an unknown colleague) to renew some of Rome's altars (ILLRP 121)⁷⁴. Another inscribed altar found on the Viminal Hill mentions the same law and dedicator, indentifying the divinity as Verminus, the god of cattle disease (ILLRP 281). The inscription on Temple C's altar clearly states that Postumius renewed (*reficiendam coeravit*) the altar, suggesting that it replaced an earlier one likely associated with the initial temple dedication. Two individuals named Aulus Postumius Albinus are known from the mid-2nd century BCE: the father, who was consul in 180 BCE, and the son, who was consul in 151 BCE. However, there is no definitive evidence to identify either as the *duumvir*. While earlier scholars often attributed the two inscribed altars to the elder Postumius and the year 175 BCE⁷⁵, when an epidemic was reported by Livy, recent scholarship⁷⁶ largely supports Coarelli's argument⁷⁷ linking the dedications to the younger Postumius in connection with the epidemic of 142 BCE⁷⁸.

60 Further supporting this later dating is the well-preserved condition of Temple C's altar. Its inscription remains in perfect condition and retains its rubrication, suggesting limited exposure to weathering before a major flood and fire impacted the

178–180; an example of trans-generational family repair is the Basilica Aemilia, dedicated in 179 BCE and renewed generations later by a member of the same family (Cassius Dio 54. 24. 2).

73 Boyancé 1940; Coarelli 1981; Champeaux 1982; Gros 1996; Leach 2010, 112.

74 Orlin 1997, 172.

75 Degrassi 1962, 337; Calabi Limentani 1994, 259 f.; De Stefano 2012, 542 is agnostic.

76 e.g., Cavellero 2018, 179–180. 199.

77 Coarelli 2014, 134–145.

78 Summary of arguments in Ruggeri 2020.

area around the mid-second century BCE⁷⁹. This state of preservation strongly supports the later date of the altar's dedication (142 BCE)⁸⁰.

The Lapis Albanus Quarries

61 We know very little about the organization of the Lapis Albanus quarries in antiquity. There is a single, uncertain epigraphic reference: CIL 14.2466, discovered in a vineyard near Marino in 1632. It records a decree dated to 31 AD by the municipal assembly of *Castrimoenium*, presumed to be located somewhere in the modern territory of Marino, though its exact location remains unknown⁸¹. The decree granted a plot of land to M. Iunius Monimus – known from another text to have been *patronus* of the municipium (CIL 14.2468) – for the construction of his tomb⁸². The land's location is described relative to certain features of *Castrimoenium*, including a *porta Meridiana* (“south gate”), the *rivom aquae Albanae* (“the course of the Alban stream/river”), and a place described as *in quo antea columnar publicum fuit* (“where there was formerly a public *columnar*”)⁸³.

62 The term *columnar* is a hapax legomenon, but as a neuter substantive derived from *columna*, ‘column’, it likely refers to a location associated with columns, interpreted as either a stone quarry or stone workshop⁸⁴. It has been compared to a *locus columnariorum* mentioned in a somewhat contemporary (early 1st century AD) inscription from Padua (CIL 5.2856). Due to geological reasons, this *locus columnariorum* could not have been a quarry but likely served as a site for finishing roughed-out stone, particularly columns⁸⁵.

63 Recently, a working area for Lapis Albanus architectural elements, including large-scale columns, was identified along the so-called *Via Castrimoeniensis* at the site of Marcandreola, about 3.5 km northwest of Marino, on the way to Rome (Fig. 2)⁸⁶. While the Marcandreola site is probably not the *columnar* mentioned in the Monimus inscription, it could be an example of the type of workshop the term describes. However, the *columnar* might also refer to a quarry. If that is the case, the specification *publicum* would be of considerable interest⁸⁷, as would the use of the past tense: “the place where the public *columnar* used to be.” In the absence of further information, the precise meaning of the *columnar* mentioned in CIL 14.2466 remains an open question.

Continued Use of Lapis Albanus

64 The use of Lapis Albanus for Aulus Postumius' altar in 142 BC demonstrates that the Valle delle Petrare extraction zone was still active over a century after its exploitation for the construction of Temples C and A (in this order)⁸⁸. However, at the end of the 2nd century BCE, when the Catuli built Temple B and substantially renewed Temple A, they opted not to use Lapis Albanus, instead choosing Anio tuff for the columns, with capitals

79 For construction phases Zink et al. 2020, 390–415.

80 So also Richardson 1992, 20.

81 Pancotti 2019 is the most recent intervention.

82 Ashby 1910, 265; Daicovici 1930, 34.

83 If the meaning of *columnar* were known with certainty, it could help locate the tomb of Marcus Junius Monimus and, by extension, the site of Castrimoenium; *vice versa*, locating the tomb of Monimus – or indeed the site of Castrimoenium – would aid in defining *columnar*. However, neither of these conditions currently holds true.

84 The definition of *columnar* as a specifically “marble quarry”, as adopted by many Latin dictionaries, is a geological impossibility at Marino.

85 Buonopane 2018.

86 Coccagna 2019 for preliminary details of the architectural elements, including Ionic and Corinthian orders, estimated at over 4 m height; Fischetti 2019, 71 for interpretation as workshop area rather than destruction of a nearby building. Fischetti writes of quarries Marcandreola, which do not seem to have been very extensive.

87 Castrimoenium was founded as a municipium by Sulla (*Liber Colonialium* 233 L). If *columnar* means quarry, an interesting point of comparison would be the public pottery kilns and woodlands mentioned in the *Lex Coloniae Genetivae Iuliae*, § 76 and 82.

88 This should not be surprising, as stone continued to be extracted here until the 20th century.

and entablatures carved from travertine. Despite the expanded range of building stone options, Lapis Albanus continued to be used in columnar architecture elsewhere in Rome. Notable examples include its use in the northern (Janus) and central (Juno Sospita) temples at S. Nicola in Carcere during their early 1st century BCE reconstructions⁸⁹, as well as in the temple on Via delle Botteghe Oscure (Nymphae or Lares Permarini; 2nd–1st century BCE). The Ionic and Corinthian elements in Lapis Albanus from Marcandreola, which are compatible with temple architecture, are dated to the late 2nd/early 1st century BCE⁹⁰.

65 In smaller-scale private architecture, Lapis Albanus also appears to have maintained its popularity for columns, as suggested by the passages of Cicero and Suetonius quoted above, as well as numerous excavations of domestic contexts in and around Rome. Besides its use for columns, Lapis Albanus continued to serve other purposes, such as for foundations and walls, through the Imperial period. After a period of reduced use during most of the Julio-Claudian era, Nero ordered its use following the Great Fire, due to the perceived fire resistance of Lapis Albanus (Tac., *Ann.* 15.43). Later examples of its use include the walls of the Forum Transitorium and, notably, in the podium of the Temple of Antoninus and Faustina.

Summary and Ways Forward

66 This study has combined the first proveniencing of Lapis Albanus stone with the first graphic reconstruction of the exterior columns from the two Mid-Republican temples of Largo Argentina. It identified at least two extraction zones in the area of Marino, from which the stone for the columns of Temples A and C was sourced. Temple C utilized material from two or more extraction zones, whereas Temple A used stone from a single source (Fig. 6). By determining the original architectural context of the sampled pieces, we concluded that the choice of quarry was not linked to a specific architectural function; rather, the material was randomly mixed at the construction site. An exception may be the stone used for the two altars, which appears to have been sourced from a very localized area, likely within a single quarry and probably from a single quarry face.

67 From an economic perspective, we can only speculate on the various scenarios regarding the quarry provider and building contractors. The historical context surrounding Temples A and C also suggests the involvement of aristocratic families as inter-generational building patrons, although whether this involvement extended to the stone quarries remains unclear. In any case, the use of a single extraction zone for Temple A around 240 BCE may indicate increased extraction capacity, allowing one provider to supply all the material needed for the columns of a single construction site. Conversely, the heterogeneity of the material used for Temple C around 270 BCE could reflect a prospection phase, during which the properties of different zones of the Lapis Albanus deposit were being evaluated for their suitability in columnar architecture. Although fragmented, this study offers glimpses into the significance of Lapis Albanus for the building industry, linking a specific quarry zone with the construction of important manubial temples in Republican Rome.

68 Clearly, this study has raised more questions than it provided answers. However, we hope that the results presented here, and the demonstration that quarry proveniencing of Lapis Albanus is methodologically feasible, will stimulate further research. The next steps will certainly require a more extensive sampling campaign, including both outcrop/quarry and architecture/monument samples. Many issues remain to be explored. For example, can we trace the use of one or more extraction zones in the Valle

89 Coarelli 1996 a; Coarelli 1996 b.

90 Coccagna 2019.

delle Petrare in other monuments, such as the altar dedicated by Aulus Postumius to Verminus? Additionally, can the analysis of other monuments, including those from the Imperial period, help us better understand the duration of the Lapis Albanus quarries' use at Marino during antiquity? The methodological approach outlined here offers a pathway forward to address such questions.

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