Archeologia e Calcolatori
36.2, 2025, 147-158
doi 10.19282/ac.36.2.2025.13

DATA INTEGRATION FOR A HYPOTHESIS OF ANCIENT LAND DIVISION IN EASTERN IRPINIA: PRELIMINARY RESULTS

1. Introduction

The research activities presented in this paper constitute a case study in Eastern Irpinia (Fig. 1) within the framework of the PRIN Project 'Investigating Resilient Roman Agricultural Landscapes in Southern Italy' (In.Res.Agri; Brancato *et al.* 2024, 392-393), identified due to the need for a deeper analysis of the data acquired during a previous research (Ditaranto 2013, 2016, 2022, and in press). The large amount of archaeological data collected during this extensive research had already, some years ago, directed specific interest toward the question of the existence of an agrarian division in the territory of *Aeclanum* (Ditaranto 2017), with some hypotheses also concerning the areas to the S – those related to the city of *Compsa* – and the sector surrounding the Sanctuary of Mefite in the Valle d'Ansanto. During the project, a program called the 'Eastern Hirpinia Land Division' was developed. Compared with the previous research, the geographical area was expanded to the hypothesized boundaries of the ancient settlements mentioned above, and the analysis was carried out using historical cartography, aerial photographs, and high-resolution satellite images.

The interesting aspect of this research, and also the most challenging, is that we are dealing with a territory for which numerous sources (literary and epigraphic) document the occurrence of land division in the Roman era, yet no traces seem to have persisted, or they are difficult to recognize because of the geomorphological nature of the region, characterized only by limited patches of flat land. The overall examination of a dataset enriched with remote sensing documentation had multiple objectives: i) to verify the possible presence of traces and survivals throughout the studied territory in order to isolate portions of land that are actually indicative of having been subject to land division operations; ii) to identify traces related to centuriation limits through the analysis of high-resolution satellite images, the application of algorithms for automatic processing and to test the automated recognition of recurring modules in land division (see Di Palma, Merola in this volume); iii) to identify one or more modules of land division.

I.D.

2. Analysis of a complex territory. State of the art

The study area is mostly hilly, with elevations ranging approximately from m 400 to 800 a.s.l. and the landscape is strongly marked by significant

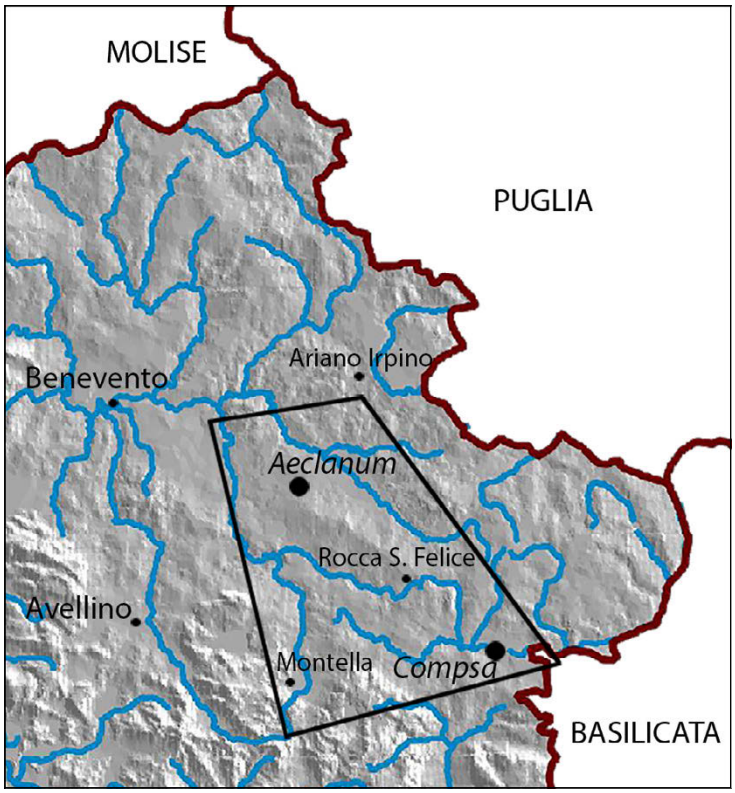

Fig. 1 – Location of the study area.

watercourses; it is very large, and understanding the historical dynamics of the involved settlements is complex (Fig. 2). The territory situated between the *agri* of *Aeclanum* and *Compsa*, and possibly relevant to a third, unknown, ancient site located near the important Mefite Sanctuary, around Frigento or Rocca San Felice, requires an analysis of the historical and topographical dynamics of this part of Irpinia in its entirety. As for the boundaries between the territories of the mentioned settlements, we refer to detailed discussion, since the debate is very broad and still ongoing (Camodeca 1996, 190; 2021; Lo Pilato 2010, 2013; Evangelisti 2014, 258, n. 2; 2017, 55-58).

2.1 Ager Aeclanensis

Aeclanum was already a partially structured pre-Roman centre between the 3rd and 2nd centuries BC. Not far from *Aeclanum*, another settlement of

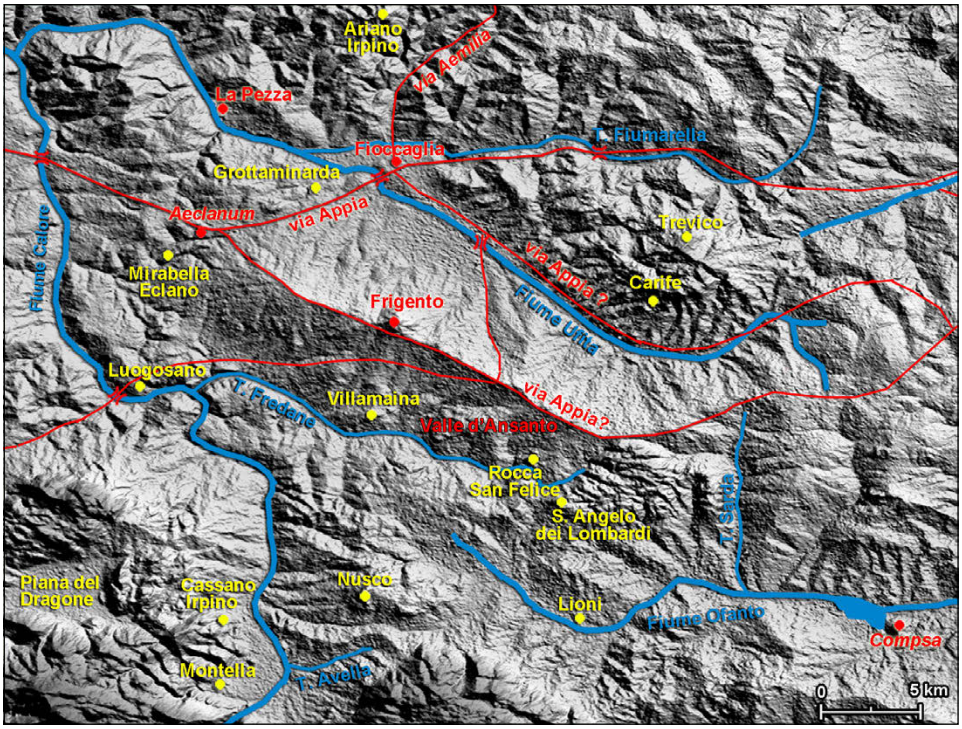

Fig. 2 – DEM of Eastern Irpinia, with the ancient settlements, the main hydrographic network, and the Roman road system.

some importance emerged during this period, immediately E of the Ufita River, at Fioccaglia place (Johannowsky 1990). In the 2nd cent. BC, *Aeclanum* was crossed by the *Via Appia*, which very likely also bordered this unnamed settlement at Fioccaglia, later called *Forum Aemilii* since it was also the head of the *Via Aemilia*, built around 126 BC. The most accepted hypothesis is that this was a *forum* serving as an administrative or directional centre, built for the community of colonists benefiting from land distribution as part of the Gracchan program of 133 BC (Camodeca 1997). However, in the surrounding territory of *Aeclanum*, no boundary stones related to land division from this period or from other significant moments in the centre's history have been discovered (founding of the *municipium*: end of 1st cent. BC; elevation to colony status: 2nd cent. AD). The only evidence of land surveying operations comes from the *Libri Coloniarum* (*Lib. Col.* I, ll. 4-6, 210; *Lib. Col.* II, ll. 5-8, 261) which tell us that the *ager* was divided using a *centuria* of 20×24 *actus* (about 710×852 m). From this, we deduce the exact

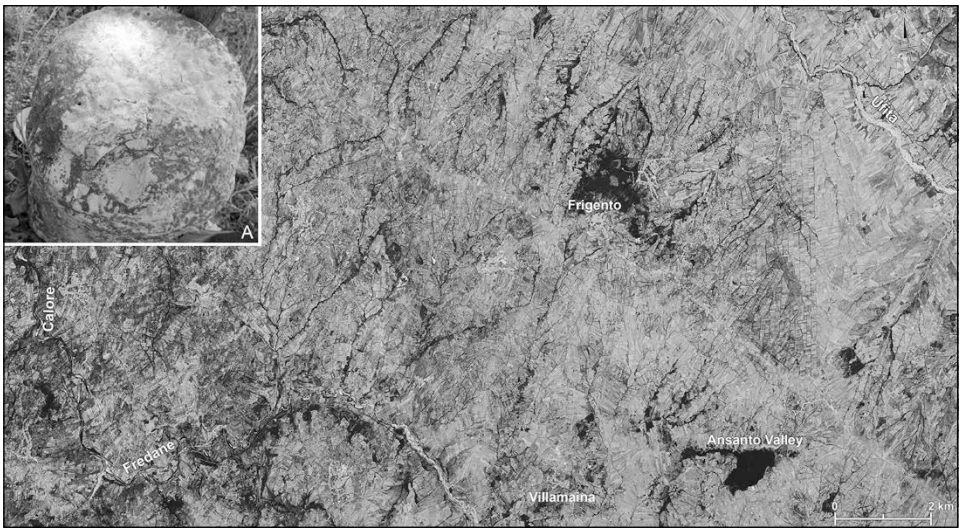

Fig. 3 – Hexagon KH-9 space photo of the central sector of the study area (ID: D3C1208-400661A012, 01-07-1974). In the square, a new boundary stone from the territory of Frigento with the *decussis* and inscription D II.

measurements of each *centuria*, its orientation (*decimanus in orientem, kardo in meridianum*), but not the specific historical moment when this operation took place. For this territory, a centuriation following the indications of the *Liber Coloniarum* has been hypothesized, with *centuriae* approximately of 710×852 m (Ditaranto 2017).

2.2 *Territory between* Compsa, Abellinum *and* Aeclanum

For this territory, a historical reconstruction has been proposed, suggesting that it transitioned from the status of *ager publicus* starting from the Second Punic War, to being governed by a *praefectura* during the Gracchan period. Later, it became a *municipium*, possibly from the Cesarian era (Camodeca 2021). Later – but not before the 2nd cent. AD – the area was assigned to *Aeclanum*, probably with the Fredane stream marking its southern boundary. The exact location of the centre remains unknown, although archaeological considerations have led in the past to a tentative placement at Frigento (Colucci Pescatori 1991, 95-98). From this area come seven boundary stones related to an ancient land division (Figs. 5-7); of these, four date back to the Gracchan period, one from the area of Villamaina, datable to 130-129 BC (Camodeca 2021, 99-100), two from the surrounding area of Rocca San Felice (*CIL* IX, 1024 -1025), precisely datable to 129 BC due

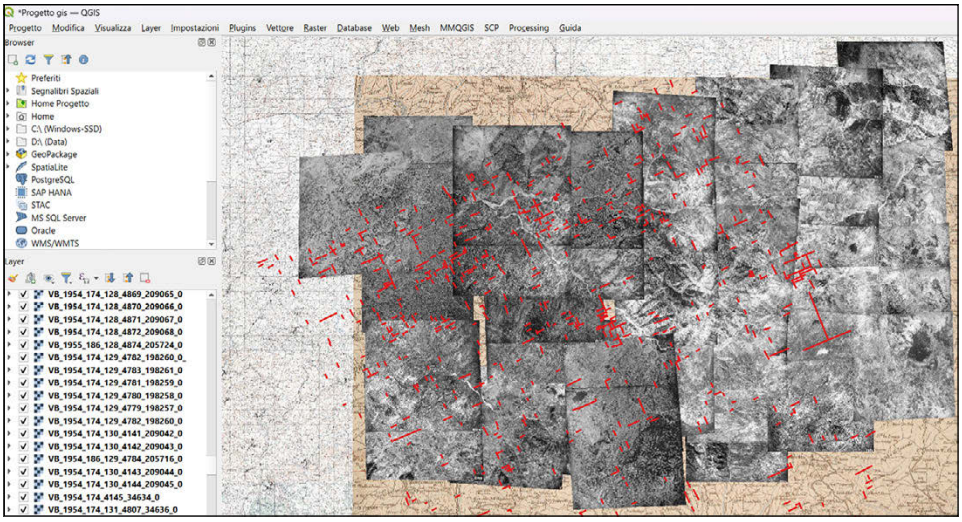

Fig. 4 – GIS platform for data management of the 'Eastern Hirpinia Land division' program.

to the presence of the third magistrate of the triumviral commission *agri iudicandis adsignatis* and one from the territory of Frigento, just unpublished (Fig. 3A). Regarding the other remaining boundary stones (*CIL* IX, 1026; Kajava, Solin 1997, 56-57) see now De Magistris 2025, who hypothesizes the pertinence of this territory to the *ager* of the colony of *Abellinum*.

2.3 Ager Compsinus

The territory that would have fallen under *Compsa* – like *Aeclanum*, a Hirpinian centre in the 3rd cent. BC – was also partly affected by the same processes as the area immediately to the N. Essentially, the entire Upper Calore Valley (the territories of Montella, Cassano Irpino, Nusco, and Lioni) became a*ger publicus* after the Second Punic War. It was assigned to a *praefectura* during the Gracchan period and, roughly during the age of Caesar, this territory was assigned to the *municipium* of *Compsa*, (Camodeca 2021). From this area come three boundary stones, found respectively in the countryside of Lioni, Nusco, and Montella, and datable to 130-129 BC (Buonopane 2010, 326-329; 2013; Colucci Pescatori 1991, 92). Confirming the implementation of the Gracchan land survey program, the *Liber Coloniarum* notes that the territory of *Compsa* was divided using Gracchan boundaries (*limitibus graccanis*: *Lib. Col.* II, ll. 1-2, 261), and that it was organized into *centuriae* of two hundred *iugera* (20×20 *actus*).

I.D.

3. Materials and methods

For the study of the investigated area, the following historical cartographic materials were acquired: a mosaic of 1:50.000 scale maps made by the Istituto Topografico Militare in 1876, particularly those relating to Sheet 63 'Salerno' and Sheet 55 'Avellino'; a composite map of IGM, Sheets 174 and 186 dating to1936, at a scale of 1:100.000; approximately 20 IGM maps of 1955 at a scale of 1:25.000, corresponding to Sheets 173, 174, 185, and 186. For the same area, around 60 vertical aerial photographs were also obtained, taken by the Istituto Geografico Militare between 1954 and 1955 and currently preserved in the archives of the Aerofototeca Nazionale in Rome. Lastly, three Hexagon KH-9 space photographs were retrieved; they offer a comprehensive view of the territory as it appeared in the 1970s (Fig. 3). To analyse this rich dataset, the creation of a geodatabase was necessary, aimed at the integration and joint management of archaeological and territorial data within a unified platform capable of virtually returning both data collected from fieldwork and those derived from subsequent processing and elaboration operations (Moscati 2017; Brancato *et al.* 2024).

For the development of this tool, the open-source software QGIS, version Bratislava 3.40.11, was employed, currently among the most widely used in archaeological and academic contexts, because of its free availability and ease

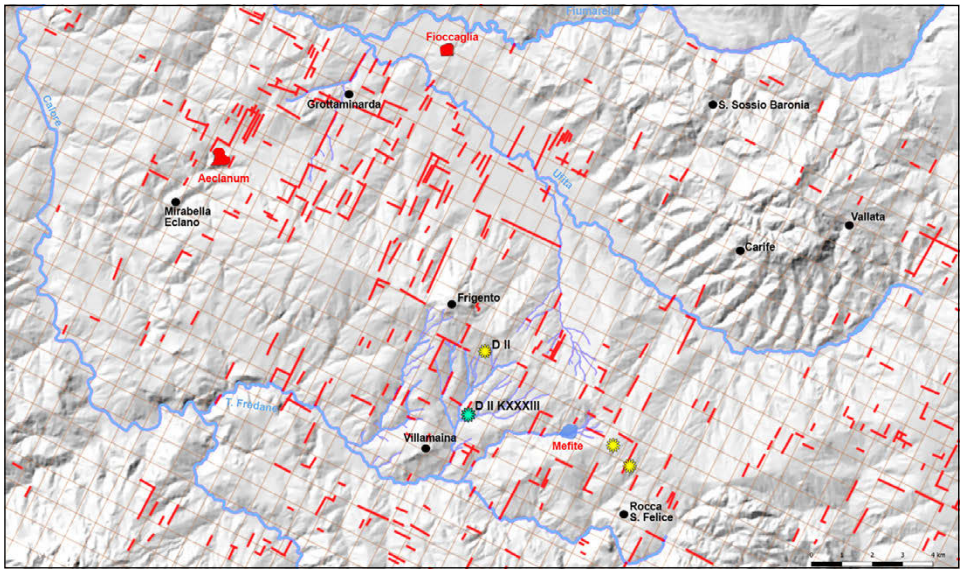

Fig. 5 – Hypothesis of agrarian division of the territory of *Aeclanum*, scheme A (20×24 *actus*; 27°E). The asterisks denote the findspots of the Gracchan boundary stones. The green asterisk is *in situ* boundary stone.

of management and implementation of heterogeneous datasets (Gazzoli 2019). A preliminary phase of the work focused on structuring the geodatabase, adopting the WGS 84/UTM 33 N (EPSG:32633) reference coordinate system. All the cartographic sources listed above were properly georeferenced and used as the base maps for the entire research work. Concurrently, these data were supplemented with a basemap representing the current territorial layout (Google Satellite), integrated via the QuickMapServices plug-in, a useful tool that allows access to a wide range of online maps through the QGIS interface. A subsequent phase in the construction of the geodatabase involved the georeferencing of historical aerial photographs (Fig. 4); these images, together with the cartographies, constitute a vast repository of information, offering a snapshot of the territory that is closer to its ancient configuration, prior to the advent of mechanised agriculture and the construction of large-scale infrastructure.

For the georeferencing of these photograms, the Polynomial 1 algorithm was used, one of the most employed methods to associate a raster image with a known geographic coordinate system. This algorithm proves particularly suitable in the presence of moderate distortions, typical of vertical aerial photographs, ensuring a good degree of precision without the need for complex and cumbersome interpolation procedures. As with the cartographic data, a dedicated and queryable layer was created for each of these photograms, accessible through the corresponding interface. The final phase of the work concerned the creation of grids using a function provided by the MMQGIS plug-in, specifically designed for the manipulation of vector layers. This tool enables a series of operations such as join, geocoding, geometric conversion, buffer generation, and central node analysis. The resulting grids, based on the preservation in maps and aerial imagery of road intersections, alignments, field divisions, ditches, and watercourses, have proven to be valuable tools for identifying further possible alignments and traces of ancient land division. Each of these elements was vectorised and accompanied by a descriptive record, compiled on the basis of information obtained from aerial images and cartographies; in addition to the dimensions and orientation, it was deemed useful to record place names when these seemed to suggest the presence of road axes and possible ancient infrastructures (e.g., Stràtola, Pilone), the agricultural vocation of the area (Vigne, Vignale, Lavinella), or the presence of potential boundaries (Limiti, Tre Croci, Crocevia, Confine).

The development of this geodatabase has thus not only enabled the gathering of data within a unified platform but also facilitated the advancement of possible interpretations regarding ancient land divisions, significantly contributing to the elaboration of diachronic reconstructive hypotheses and models of the Irpinian historical landscape.

V.G.

4. Discussion

Based on the analysis described above, three agrarian division grids have been identified. In the area between *Aeclanum*, the Ufita River to the E, and Rocca San Felice to the S (although the most substantial survivals extend as far as Frigento), a grid oriented 27° NE with a module of 20×24 *actus* has been identified (scheme A: Fig. 5). The alignments mostly consist of surviving

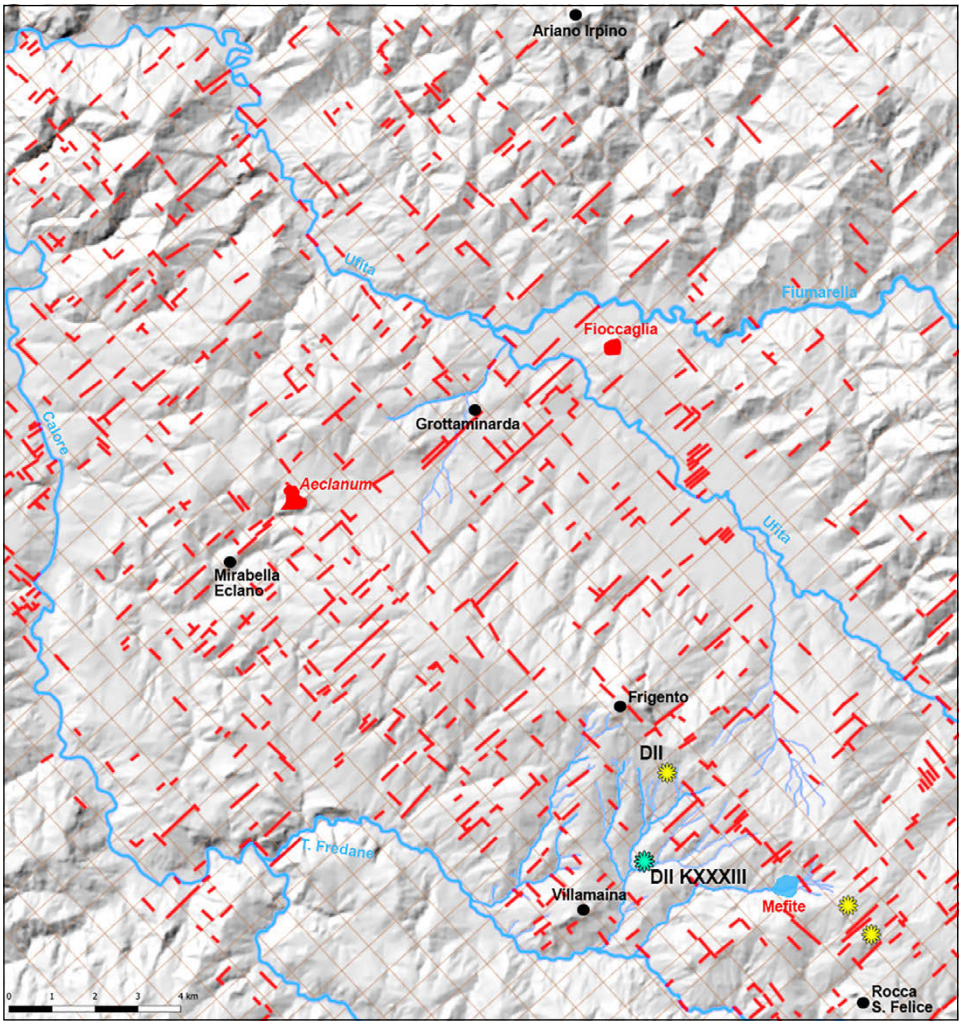

Fig. 6 – Hypothesis of agrarian division of the territory of *Aeclanum*, scheme B (20×24; 47°E *actus*).

Fig. 7 – The centuriated territory of the *ager Compsinus* close to Montella plain, in a aerial view from E.

watercourses, country paths, field boundaries, ditches, and drainage channels. If at least part of the centuriated territory corresponds to this area where such features have been identified, we may be witnessing a deliberate choice made by Roman land surveyors to divide the flattest sector of the entire area. This is the plain crossed by the *Via Appia* and by the Ufita River, predominantly extending along the river's left bank. Another substantial group of survivals identifies a grid of 20×24 *actus*, rotated 47° NE, within a territory stretching from the Calore River to the Fiumarella stream (scheme B: Fig. 6). It is difficult to establish a precise chronology for the two possible centuriation grids (for the discussion on the chronological attribution, also in relation to the data from field surveys, see Ditaranto, Giordano in press).

It cannot be ruled out that one of the two was implemented during the Gracchan period, or during the Imperial period adopting the 'non-standard' 20×24 *actus* module (Castagnoli 1958, 22). Within the intermediate territory between the *agri* of *Aeclanum* and *Compsa*, several surviving alignments appear to correspond, in the majority of cases, to the orientation defined by scheme B (Fig. 6) and they should refer to an ancient land division implemented in this sector probably starting from the 2nd century AD, when it was included in the territory of the colony of *Aeclanum*. In the territory located S of the Fredane Stream, the identification of possible traces and survivals of agrarian divisions proves more complex. The geomorphology of the area

is more rugged, and it must be considered that the numerous watercourses may have shifted or changed over the centuries. Nevertheless, a 20×20 *actus* module-oriented N-S has been hypothesized or it was possible, due to the position of the three boundary stones, that the *ager Compsinus* included two different and adjoining centuriations. It should be noted that the flattest part of this territory is located between Montella, Cassano Irpino and Nusco (Fig. 7), from where two of the known boundary stones come.

I.D.

5. Conclusions and research perspectives

Thanks to the large amount of collected data, the work on this sector of Irpinia within the framework of the PRIN In.Res.Agri project will continue to provide answers to the still open questions regarding the agrarian division of this extensive territory. Although for the area of *Aeclanum* we have data from systematic archaeological surveys that allow us to more precisely outline the centuriation program(s) (Ditaranto in press and Ditaranto, Giordano in press), for the territory of *Compsa* there is a significant gap in the diachronic understanding of settlement dynamics between the prehistoric and medieval periods, with the exception of some limited sectors (Rea 1982; Colucci Pescatori 1991; Carfora *et al.* 2014; Pugliese 2017).

I.D., V.G.

Immacolata Ditaranto, Vincenzo Giordano
Istituto di Scienze del Patrimonio Culturale - CNR
immacolata.ditaranto@cnr.it, vincenzogiordano@cnr.it

Acknowledgements

The project 'In.Res.Agri – Investigating Resilient Roman Agricultural Landscapes in Southern Italy. An Integrated and Open IT Approach to Modelling Centuriation through Archaeology, Remotely Sensed Data, Palynology and Ancient Texts' was funded by the European Union – NextGenerationEU – Piano Nazionale di Ripresa e Resilienza (PNRR) – Missione 4 'Istruzione e Ricerca' – Componente C2 – Investimento 1.1, 'Fondo per il Programma Nazionale di Ricerca e Progetti di Rilevante Interesse Nazionale' (PRIN) – Project Code 2022SMJCHX, CUP: B53D23001910006.

References

Brancato R., Ferrari V., Ditaranto I., Merola P., Rossi I. 2024, *Investigating resilient Roman agricultural landscapes in Southern Italy. An integrated and open IT approach to modeling centuriation*, «Archeologia e Calcolatori», 35.2, 387-400 (https://doi.org/10.19282/ac.35.2.2024.41).

Buonopane A. 2010, *Iter epigraphicum Compsanum*, «Rendiconti Pontificia Accademia Romana di Archeologia», 83, 309-331.

Buonopane A. 2013, *Un nuovo termine graccano dall'ager di Compsa*, «Agri Centuriati», 1, 185-202.

Camodeca G. 1996, *Istituzioni e società di Abellinum romana*, in F. Barra, G. Colucci Pescatori, E. Cuozzo, *Storia illustrata di Avellino e dell'Irpinia*, I, Pratola Serra, Sellino & Barra, 177-192.

Camodeca G. 1997, *M. Aemilius Lepidus, cos. 126 a. C., le assegnazioni graccane e la via Aemilia* in *Hirpinia*, «Zeitschrift für Papyrologie und Epigraphik», 115, 263-270.

Camodeca G. 2021, *Note sull'Irpinia in età romana*, in A. Visconti, M. Lanzillo (eds.), *Studi sull'Irpinia antica*, Napoli, Tiotinx Edizioni, 89-126.

Carfora P., Mataluna S., Renda G., *Il territorio di Sturno*, «Atlante tematico di Topografia Antica», 15, 8, 227-396.

Castagnoli F. 1958, *Le ricerche sui resti della centuriazione*, Roma, Edizioni di Storia e Letteratura.

Colucci Pescatori G. 1991, *Evidenze archeologiche in Irpinia*, in *La romanization du Samnium aux II^e et I^e siècle av. J.C.*, Naples, Publications du Centre Jean Bérard, 85-122.

De Magistris E. 2025, *Termini graccani e terre di Mefite in Hirpinia*, «Agri Centuriati», 22, 51-76.

Ditaranto I. 2013, *Aerotopografia e fotogrammetria finalizzata per la carta archeologica di Aeclanum*, «Archeologia Aerea», 7, 53-64.

Ditaranto I. 2016, *Ancient topography of the Mid Calore Valley: The city of Aeclanum and its territory*, in *3rd International Landscape Archaeology Conference (Rome 2014)*, (https://doi.org/10.5463/LAC.2014.36).

Ditaranto I. 2017, *Il contributo della fotografia aerea allo studio delle antiche divisioni agrarie in Irpinia Orientale*, «Archeologia Aerea», 10, 146-153.

Ditaranto I. 2022, *Siti preistorici e protostorici del territorio di Grottaminarda (AV): documentazione e inquadramento topografico*, in R. Auriemma, G. Coluccia, R. Guglielmino, G. Semeraro (eds.), *Humilis Italia. Studi di storia e archeologia in ricordo di Cosimo Pagliara*, «Studi di Antichità», 18, 25-40.

Ditaranto in press, *Carta Archeologica di Aeclanum e del suo territorio*.

Ditaranto, Giordano in press, *Indagini sulle divisioni agrarie degli agri Aeclanensis e Compsinus: considerazioni su un territorio complesso tra l'età repubblicana e quella imperiale*.

Evangelisti S. 2014, *Signacula da Aeclanum*, in *CIL (IX e X). Alcune note*, «Instrumenta Inscripta», 5, 257-266.

Evangelisti S. 2017, *Regio II. Apulia et Calabria. Aeclanum - Ager inter Compsam et Aeclanum*, in *Supplementa Italica*, 29, Roma, Edizioni Quasar, 37-251.

Gazzoli S. 2019, *QGIS, database ed epigrafia: un progetto in corso*, «Archeologia e Calcolatori», 30, 519-522 (https://doi.org/10.19282/ac.30.2019.44).

Johannowsky W. 1990, *L'abitato tardo-ellenistico a Fioccaglia di Flumeri e la romanizzazione dell'Irpinia*, in M. Salvatore (ed.), *Basilicata. L'espansionismo romano nel sud-est d'Italia*, Venosa, Osanna Edizioni, 269-280.

Kajava M., Solin H. 1997, *Le iscrizioni aliene del Museo Irpino*, «Epigraphica», 59, 311-351.

Lo Pilato S. 2010, *Organizzazione e destrutturazione dell'insediamento di Aeclanum: considerazioni*, in R. Giuliani, G. Volpe (eds.), *Paesaggi e insediamenti urbani in Italia meridionale fra Tardoantico e Altomedioevo. Atti del Secondo Seminario sul Tardoantico e l'Altomedioevo in Italia Meridionale (Foggia - Monte Sant'Angelo 2006)*, Bari, Edipuglia, 349-365.

Lo Pilato S. 2013, *Il territorio di Aeclanum in età tardo antica ed altomedievale*, in G. Passaro (ed.), *Mons. Nicola Gambino (1921-2000), sacerdote e storico dell'Irpinia antica nel ricordo di amici ed estimatori. Atti del Convegno di Studi (Rocca San Felice 2011)*, Grottaminarda, Delta 3 Edizioni, 59-96.

Moscati P. 2017, *Archaeological computing and ancient cities: Insights from the repository of «Archeologia e Calcolatori»*, «Archeologia e Calcolatori», 28.2, 47-66 (https://doi.org/10.19282/ac.28.2.2017.03).

Pugliese A. 2017, *Ricognizioni archeologiche nel territorio di Morra De Sanctis: Contributi per una Carta Archeologica*, «Atti e memorie della Società Magna Grecia», 2, 105-140.

Rea R. 1982, *Primi risultati della ricognizione archeologica nel territorio di Conza*, in *Conza alla ricerca del passato. Atti dell'incontro-dibattito (Conza 1979)*, Calitri, Ed. Pro Loco Conza, 37-40.

ABSTRACT

The case study identified in Eastern Irpinia includes the territories belonging to the colony of *Aeclanum*, to the N, and ancient *Compsa*, to the S. It is a vast area bordered by the Calore River to the W, which reaches and exceeds the banks of the Ufita River to the E. It offers the opportunity to study a territory that has been little explored in relation to the topic of agrarian divisions, likely due to its decidedly complex geomorphological nature, characterized by a predominantly hilly landscape and rich hydrography, with limited plains. Furthermore, the historical interpretation of the entire territory is equally complex, for which the boundaries of each center can only be hypothesized. Following the indications of the *Liber Coloniarum*, which mentions divisions for both *Aeclanum* and *Compsa*, and considering the discovery of eight agrarian division stones, of which at least 6 dating to Gracchan period, an attempt is being made to reconstruct the agrarian divisions implemented in the territory through the analysis of historical cartography, aerial photographs and with the aid of machine-learning applications starting from high-resolution satellite images.