

## 7. THE GEOARCHAEOLOGICAL CONTEXT OF THE AREA OF SANTA MARIA IN PADOVETERE

The archaeological area has been investigated since the late 1950s. Since the beginning, particular attention has been paid to the geomorphological dynamics underlying the foundation of the most representative building in the area, a parish church attributed to the early 6<sup>th</sup> century AD. In particular, the relationship between the ecclesiastical building and a paleochannel of the Po river which flowed, in Late Antiquity, a few metres south-west of the parish church, has always aroused great interest (Rucco, 2021 and references) (Fig. 7.1).

Much has been written about an artificial canal, traditionally called *Motta della Girata*, originally dated to the Etruscan age but recently attributed, based on radiocarbon dating, to Late Antiquity (Rucco, 2015). This canal branched off from the Po paleochannel about 150 m south-east of the parish church and headed towards the northern outskirts of the nearby town of Comacchio, in a place where archaeological investigations have made it possible to highlight the traces of a port (Grandi and Negrelli, 2021).

The area is thus characterised by a high archaeological value. This value, and the general complexity of the buried archaeological record, was enriched by the discovery of the riverine barge described in this volume.

Very recent archaeological investigations carried out by the teaching of Medieval Archaeology at Ca' Foscari University of Venice have shed light on the very early stages of occupation of the area datable to the end of the 5<sup>th</sup> century, i.e., precisely coeval to the barge (Fig. 7.2).

Geoarchaeological investigations conducted in the last decade on the entire archaeological area allowed to define the main depositional units that characterise it, leading to the proposition of an overall geomorphological and paleo-environmental framework for Late Antiquity.

### 7.1 *The geomorphological setting*

Two major geomorphological units characterise the Santa Maria in Padovetere area (Beltrame *et al.*, 2021) (Fig. 7.3).

The first is an almost 500-metre-wide abandoned channel belt of the ancient Po river (*Padus vetus*, 'Padovetere'), running NW-SE and flanking the parish church. The second is the N-S relict beach ridges cut by the Po channel belt and formed between 3500 and 2700 years ago (Stefani and Vincenzi, 2005). Over the following centuries, the coastline shifted about 5 km further east (Castiglioni *et al.*, 1999).

During Late Antiquity, the Santa Maria in Padovetere area was far inland from the coast. Ancient rivers in the area were given different names (*Eridanus*, *Padoa*, *Padus*), but they all correspond to various Po river channels. The shape of the beach ridges suggests that, during the 4<sup>th</sup> century BC, the main branch of the Po river probably debauched into the sea just 2.5 km southeast of Santa Maria in Padovetere (Cremonini, 1993). Then the river mouth shifted to the northeast and remained in the Porto Garibaldi area until the 4<sup>th</sup> century AD (Bondesan, 1990; Bondesan and Giovannini, 1994). Available data suggest that, in Late Antiquity, the Po river branch near Santa Maria in Padovetere (*Padus vetus*) was a residual channel (Bondesan, 2001; Balista and Berti, 2016-2017).

The study area is crossed to the east by the early-Medieval *Motta della Girata* canal, which starts from the Po residual channel about 100 m downstream of the wreck site (Figs. 7.4, 7.5). The canal, almost 30 m wide and 2.5 m deep, is filled with fine-grained, organic-rich sediments (Rucco, 2015). Radiocarbon dating of a peat sample collected at the bottom of the sedimentary fill of the *Motta della Girata* Canal some 300 m E of the wreck site was dated to 1260 ± 30 BP (669-779 cal AD, Tab. 7.1). This indicates that the canal was already active in the 7<sup>th</sup> century AD.

A core drilled outside the canal in 2015, the PEG1 core, indicates that a thin, organic-rich silt level separates the depositional top of the beach ridges from a 2.5 m alluvial succession that consists of sand and silt, and continues to the present topographic surface (location shown in Fig. 7.5, revised stratigraphic log in Fig. 7.6). A charcoal fragment collected from this organic-rich layer was dated 1550 ± 30 BP (423-574 cal AD, Tab. 7.1).

| Core and depth (cm)           | LabCode     | Radiocarbon Age (yr BP) | Calibrated Age AD [start-end] probability% | Material | Elevation (m asl) | Latitude     | Longitude    |
|-------------------------------|-------------|-------------------------|--|----------|-------------------|--------------|--------------|
| PEG1/PEG1 bis<br>255-260      | Beta-354936 | 1550 ± 30               | [423-574] 95.4%                            | Charcoal | -3.30/-3.35       | 44°40'46.1"N | 12°07'37.2"E |
| MDG canal PEG3<br>160-165     | Beta-354937 | 1260 ± 30               | [669-779] 85.3%                            | Peat     | -2.30/-2.35       | 44°40'44.3"N | 12°07'38.6"E |
| Barge excavation<br>Depth N/A | LTL6271A    | 1625 ± 45               | [332-545] 95.5%                            | Rope     | N/A               | 44°40'30.1"N | 12°07'20.0"E |

Tab. 7.1. Radiocarbon dates from Rucco, 2015 (Beta-354936, Beta-354937), and Balista and Berti, 2016-2017 (LTL16271A).



Fig. 7.1. General setting of the study area.

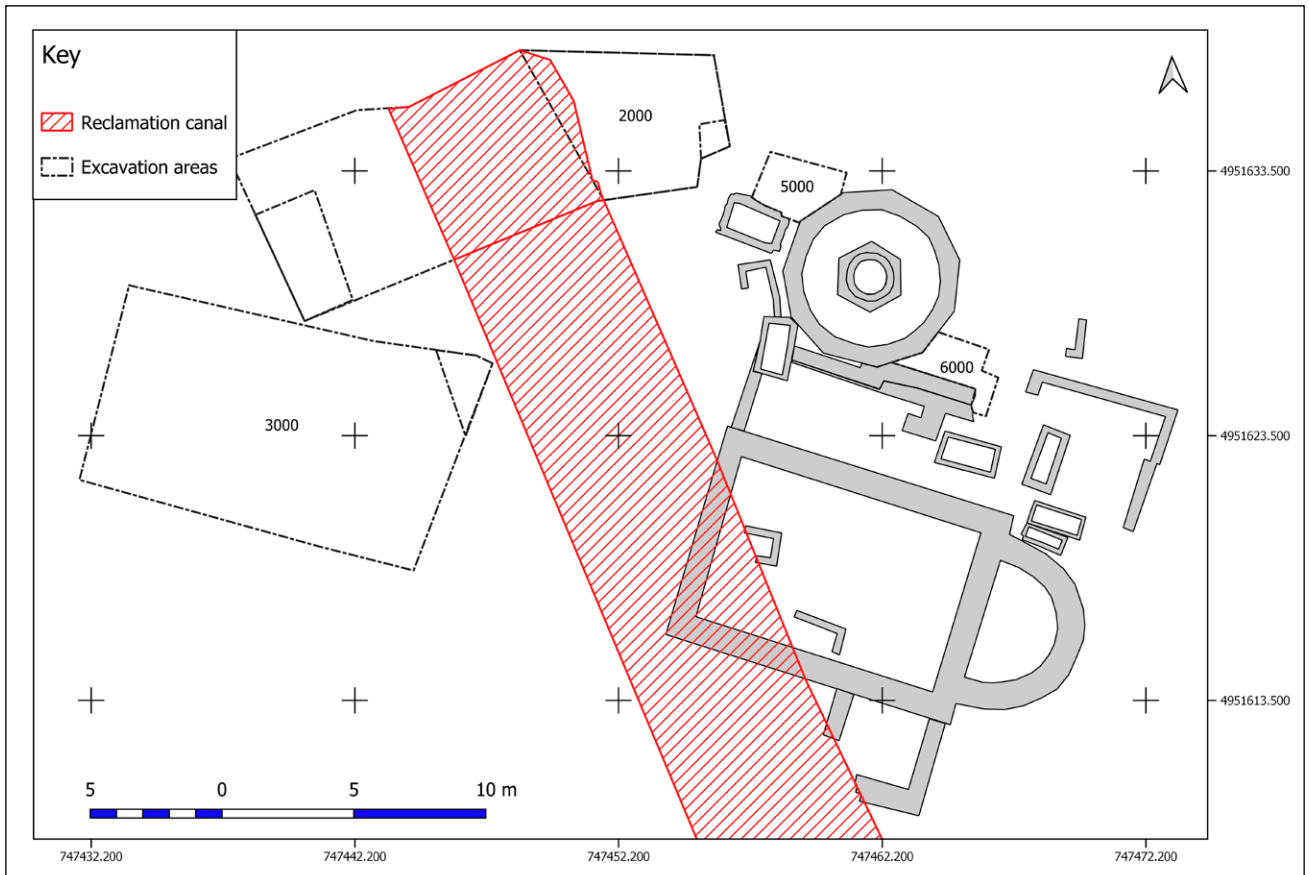
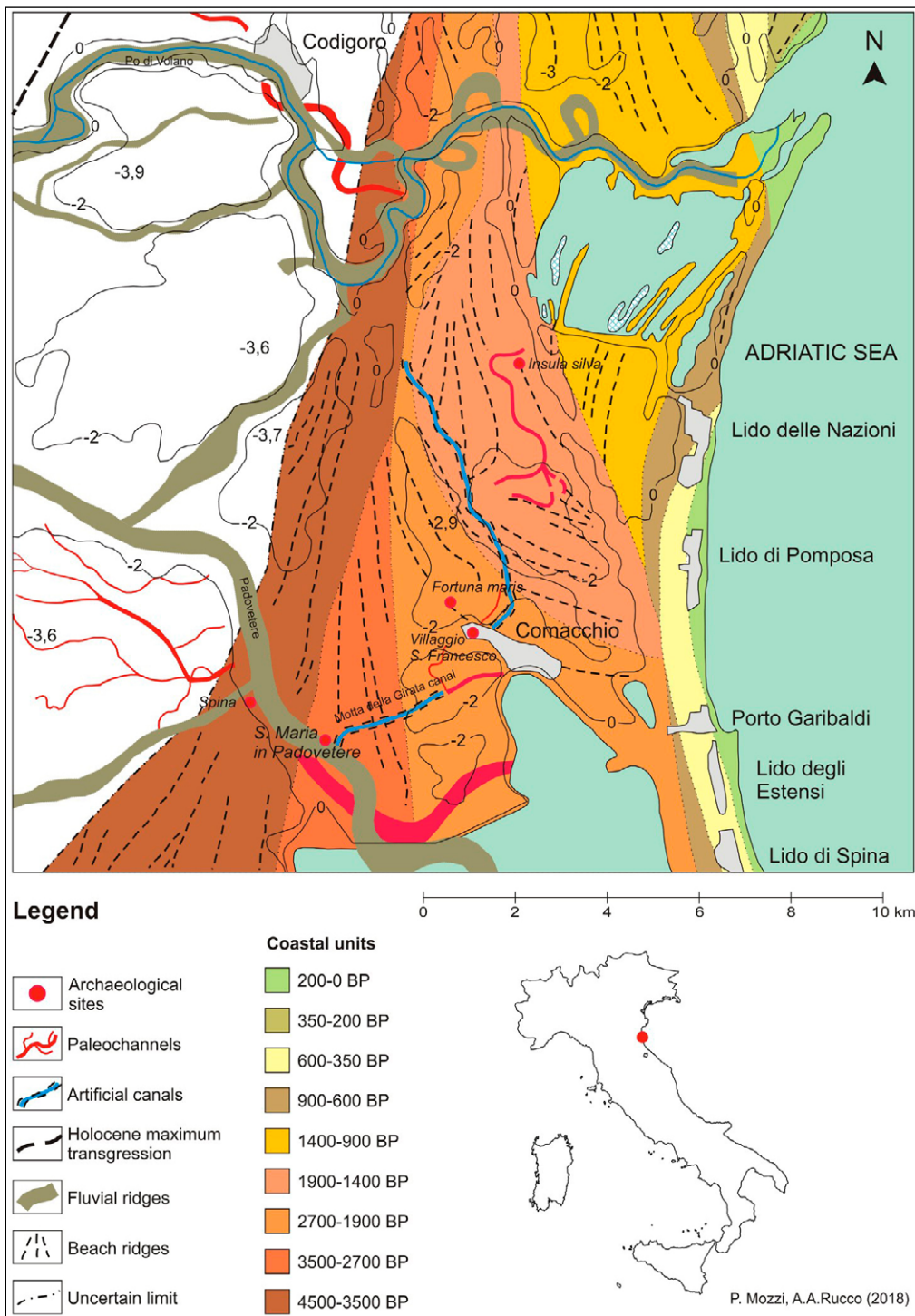


Fig. 7.2. Excavation areas besides the Santa Maria in Padovetere parish church (drawing: A. A. Rucco).



7.3. Geomorphological setting of the study area (modified from Stefani and Vincenzi, 2005).

## 7.2 Field methods

The first step of the research in the archaeological area of Santa Maria in Padovetere involved the creation of a DSM (*Digital Surface Model*) to identify micromorphological anomalies related to both geological and anthropic near-surface structures. To achieve the result, a photogrammetric survey was carried out with a Mavic Enterprise Dual DJI aircraft on 06/16/2021. 346 photographs were taken and

processed with *Agisoft Photoscan*. The field topographic survey was carried out with a Geomax Zenith 16 GNSS, based on WGS 84, UTM 32N reference system. Altitude values were calibrated according to the Italy ITG2009 geoid (Fig. 7.7). Coring was carried out using an Edelman combination-type auger. The field description included grain size, sedimentary structures, colours (with reference to the Munsell Soil Colour Charts), pedological features (nodules, mottles) and paleontological content (shells, plant remains,



Fig. 7.4. Main geomorphological units in the Santa Maria in Padovetere site.

wood, charcoal). Radiocarbon dates from Rucco (2015) and Balista and Berti (2016-2017) were calibrated using the OxCal 4.3 software (Bronk Ramsey, 2009) and the calibration curve IntCal13 (Reimer *et al.*, 2013) (Tab. 7.1).

### 7.3 Results

It should be noted that the area corresponding to the state-owned space is much more conservative of the original landforms than the immediately external one. As an example, it can be highlighted that elevations are on average 50 cm higher than outside. Undoubtedly, a decisive role in this sense was played by the very early acquisition of the land by the Italian State, which preserved it from the impact of agricultural activities.

The DSM spans approximately between -0.3 and -2 m asl. A major landform is the *Motta della Girata* canal, which crosses the eastern portion of the area in SSW-NNE

direction. The DSM has also presented a marked depression just SW of the parish church that corresponds to a trace of the Padovetere palaeochannel. The space immediately surrounding the parish church inherits not only the relief of the natural levee on the left bank of the Padovetere river but also the overall geometry of the crevasse splay on which the whole occupation of the site took place.

In satellite images, the beach ridges in the Santa Maria in Padovetere area appear to be regularly spaced, almost parallel sandy belts (Fig. 7.4). In front of the Santa Maria in Padovetere site, the Po river paleochannel splits into two secondary channels, each about 60-80 metres wide, around what appears to be a fluvial island in remote sensing images. The hull of the sewn-plank barge lies on the left bank of the northern minor channel.

Stratigraphic data from our survey and Rucco (2015) allowed us to define the general stratigraphy of the area (Fig. 7.7). The PEG1/PEG1bis cores were drilled a few metres north of the left bank of the *Motta della Girata* Canal. Beach

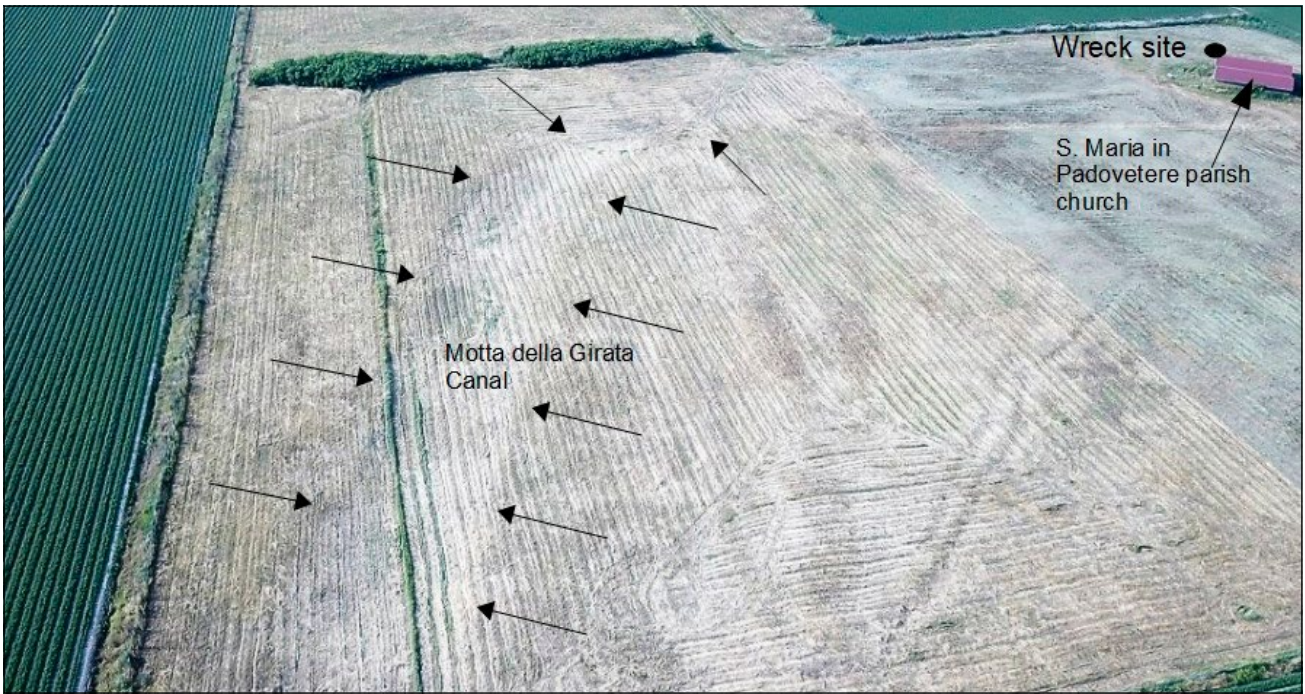


Fig. 7.5. The Motta della Girata Canal from a N-S perspective (photo: A.A. Rucco).

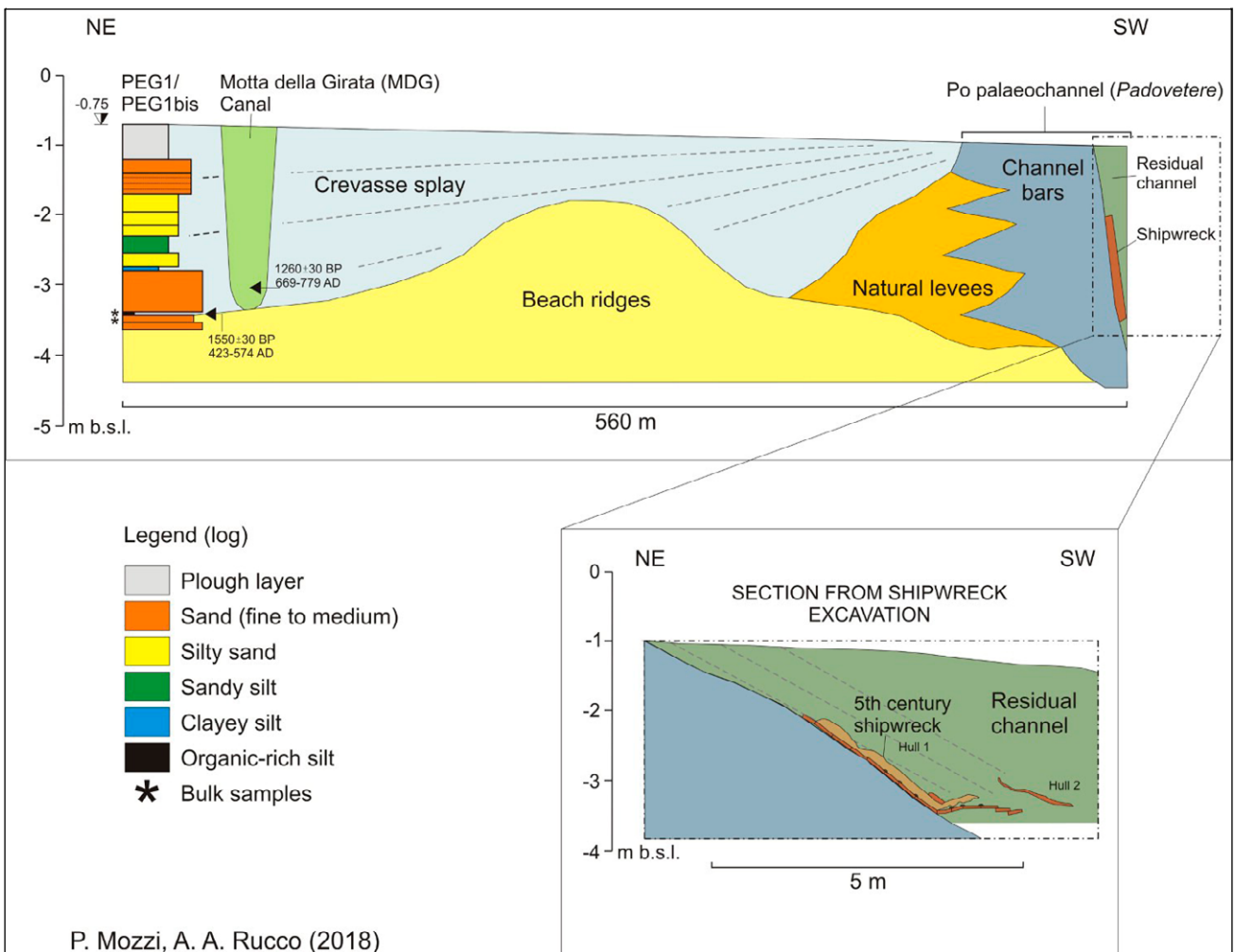


Fig. 7.6. Stratigraphic profile between PEG1/1bis and the wreck site (localization in fig. 7.4).

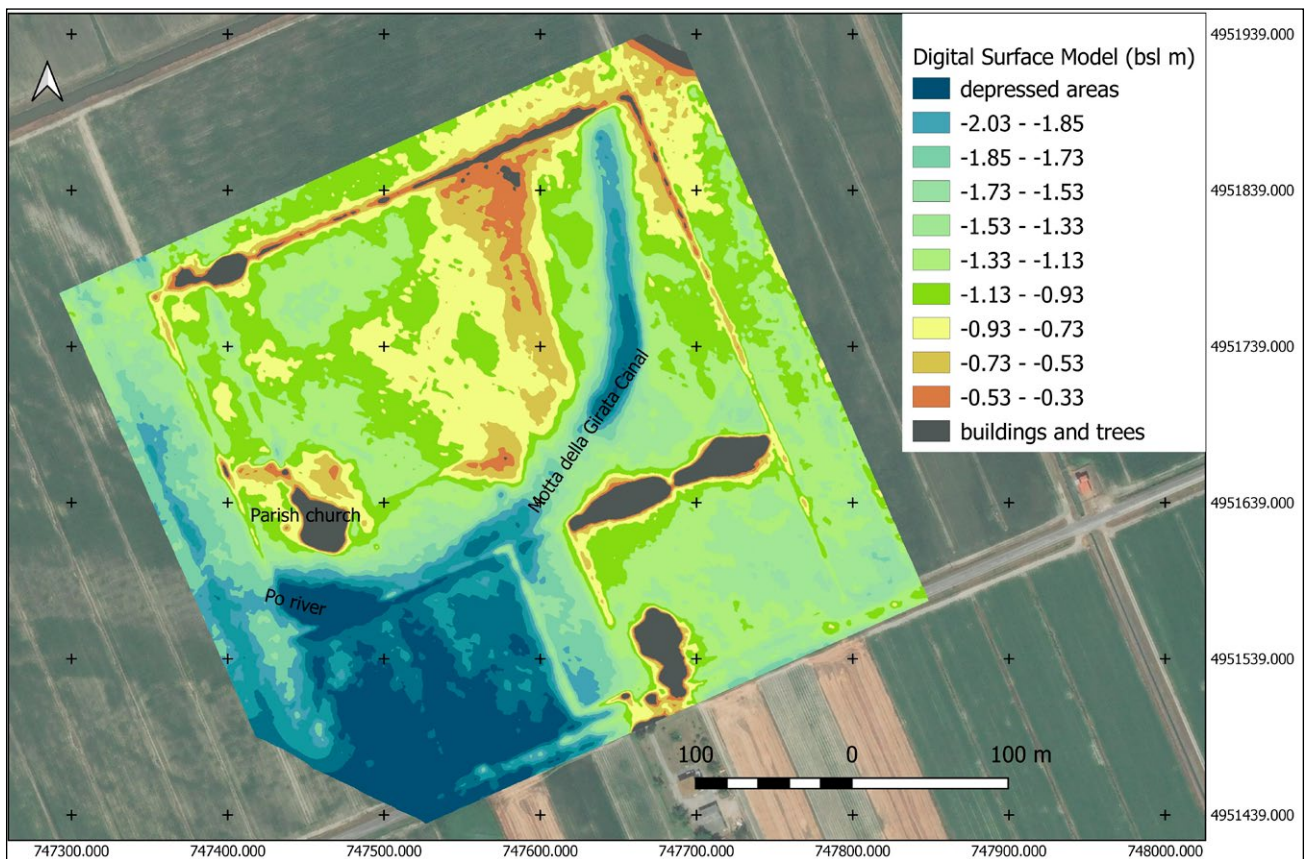


Fig. 7.7. DSM of the study area.

ridge deposits (medium sand, slightly silty, containing many fragments of marine bivalve shells, especially *Cerastoderma glaucum*) were found 2.6 m below the topographic surface. Directly above is the organic-rich silt level dated to  $1550 \pm 30$  BP (423-574 cal AD). The overlying 2.5-metre alluvial succession is dominated by alternating layers of sand, silty sand, and sandy silt up to the present topographic surface. These alluvial deposits are interpreted as crevasse-splay sediments. Lithofacies assemblage and remote sensing indicate faint traces of radial minor channels emanating northward from the Po channel (Fig. 7.8).

This interpretation is consistent with the hypothesis proposed by Balista and Berti (2016-2017) that the first tract of the *Motta della Girata* Canal was realised by taking advantage of a crevasse channel that cut through the natural levee of the Padovetere palaeochannel.

#### 7.4 Discussion and final remarks

The alluvial stratigraphy indicates that the crevasse splay at Santa Maria in Padovetere was deposited after 423-574 cal AD. However, given that the foundation of the Santa Maria in Padovetere parish church, which is on top of these alluvial sediments, dates to the first half of the 6<sup>th</sup> century,

the crevasse splay activity is further constrained between 423 AD and approximately the end of the fifth century (Fig. 7.9). This reconstruction is further confirmed by archaeological data coming from the cemetery excavated some 50 m east of the junction between the *Motta della Girata* Canal and the Po river. The excavation carried out in 2022 in this area by Ca' Foscari University of Venice made it possible to understand that the already known graves of this cemetery, characterised by the presence of 5<sup>th</sup> century pottery and glass assemblages, were realised rightly on top of the crevasse splay deposits described (Fig. 7.8). This indicates that the time interval when a flood (or a cluster of floods) activated the Po river residual channel and fed the crevasse splay at Santa Maria in Padovetere partly overlaps with the end of the barge's life. It is possible that the barge's sinking was related to one of the high-magnitude floods that formed the crevasse splay.

At the regional level, this period of fluvial instability is coeval to a phase of alluvial ridge aggradation of the main course of the Po river, which occurred from the mid-4<sup>th</sup> century to the end of the 5<sup>th</sup> century. It is also coeval to the period of enhanced avulsion and aggradation of the channel belts of minor streams that flowed from the Apennines to the Po plain and the Adriatic Sea during the 5<sup>th</sup> and 6<sup>th</sup> centuries (Cremonini, Labate, and Curina, 2013).

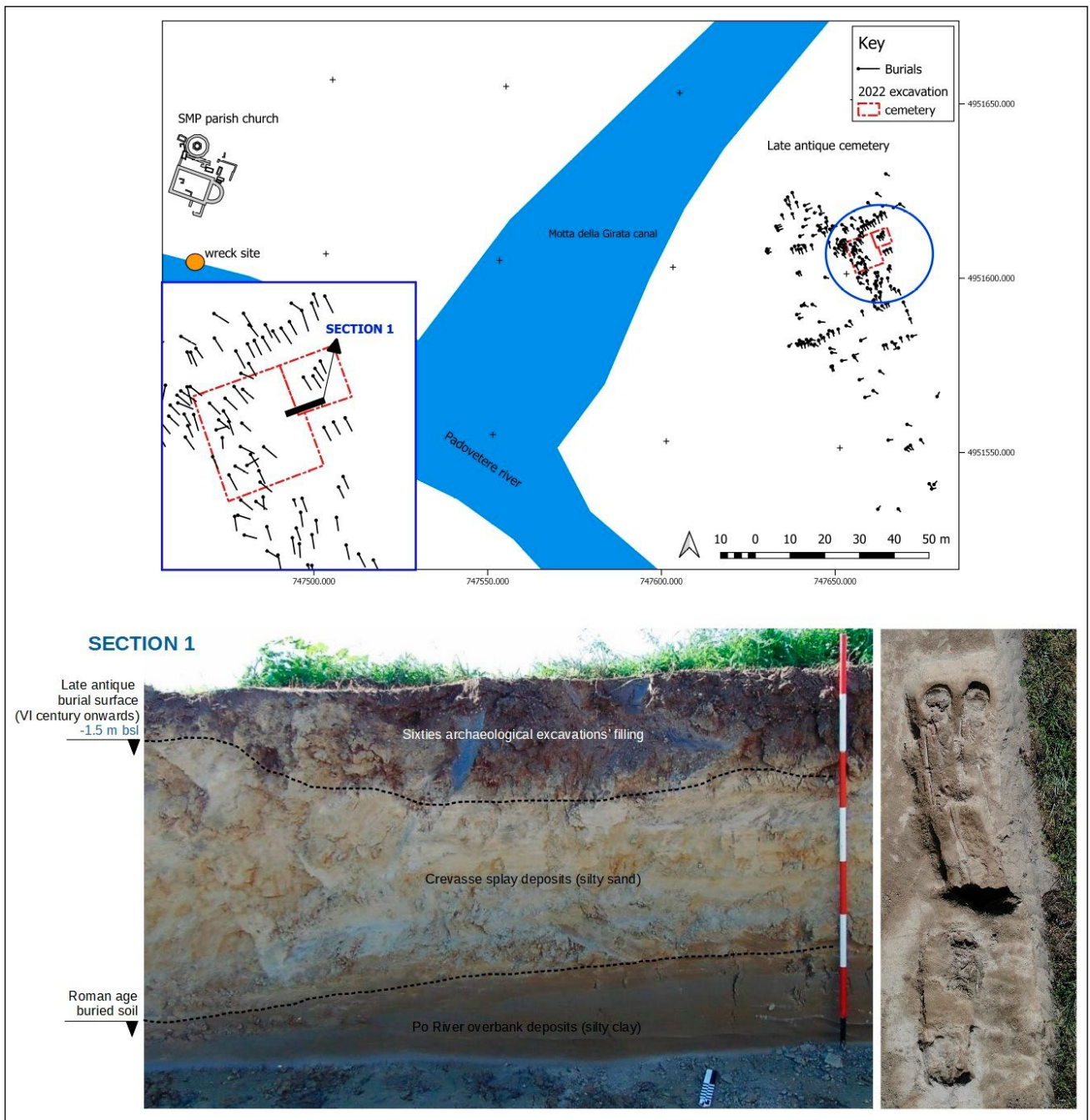


Fig. 7.8. Crevasse splay deposits documented in 2022 excavations (drawing and photos: A.A. Rucco).

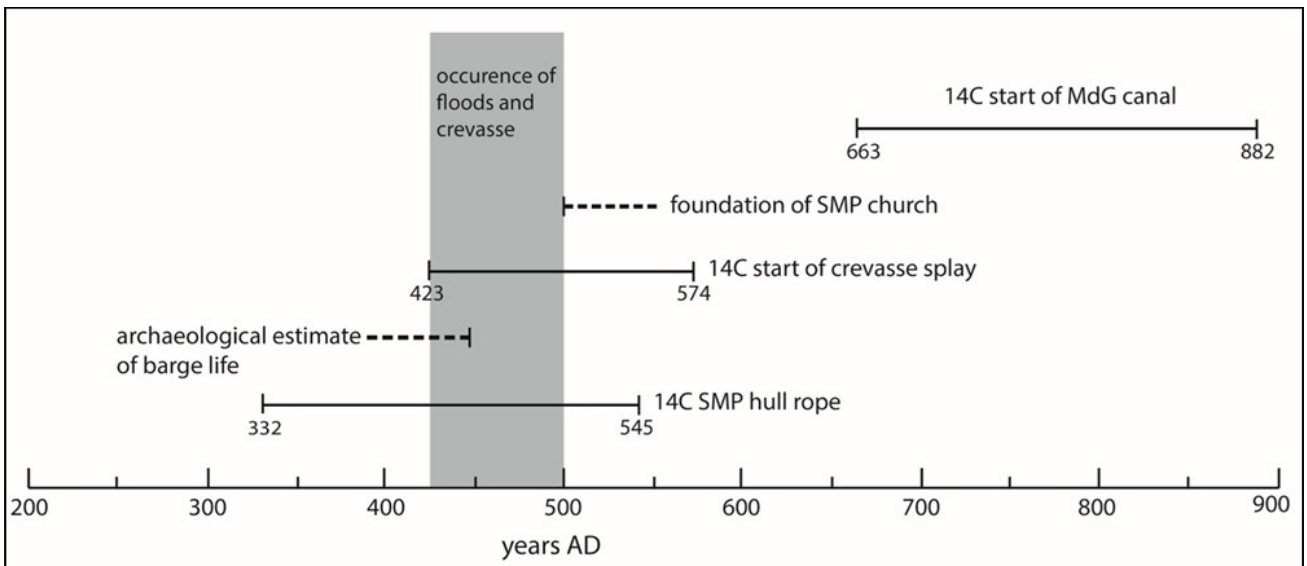


Fig. 7.9. Chronology of the main events that occurred in the Santa Maria in Padovetere area based on radiocarbon dating and archaeological evidence.