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The late-antiquity environmental crisis in Emilia region (Po river plain, Northern Italy): Geoarchaeological evidence and paleoclimatic considerations

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ABSTRACT

For about four decades in Italy local, scientific literature has occasionally dealt with fluvial avulsions, suggesting they should be considered as genetically linked to a peculiar climatic worsening that occurred in the late-6th century AD (the so-called “Paul the Deacon Deluge”). Research performed by the Soprintendenza per i Beni Archeologici dell’Emilia-Romagna over the last few years has allowed better definition of the timing of a more articulated alluvial history, mainly concerning the Roman Imperial age and Late-Antiquity (1st–6th century AD). The main stratigraphic details of fourteen selected archaeological excavation sites (eleven recently surveyed and three reviewed from the literature) performed in the cities of Modena, Bologna and related surroundings have been summarized. Eleven ¹⁴C dates, ranging between the years 130 AD and 810 AD, allowed us to chronologically delimit a first framework for the riverbed network behaviour during ancient times in the central part of the region. The alluvial process appeared to be continuous throughout the time span examined. The fan trench was the most sensitive reach of the river system. It started to aggrade during the 4th century AD. During the 5th century AD and probably after the end of the 6th century AD, a number of avulsions occurred. This indicates that the fluvial system was in a metastable equilibrium, whose behavioural threshold was finally overcome. Hence, the importance of the supposed year 589 AD crisis (the “Deluge”) appears to be less than previously supposed. The riverbed aggradation became evident immediately after the Roman Empire’s economic and demographic crisis of the 3rd century AD, and it was probably due to the loss of the land preservation systems in the mountain catchment areas. The long duration of the aggradation phase suggests that more than one human settlement phase in the minor catchment areas and/or a minor climatic worsening pulse probably occurred during the 5th century AD. The starting of the aggradation also coincided with the end of the Petit Maclu 1 high level phase of the European lakes. Notwithstanding this, the climate’s role as a forcing co-factor can still be hard to evaluate positively due to the lack of local proxy data.

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1. Introduction

In Italy a poorly known paleoclimatic topic still exists that has never been deeply studied, even though it represents a famous *topos* in archaeological and geoenvironmental literature. This is the so-called “Paul the Deacon Deluge” (PDD) dating back to the year 589 AD and usually linked to the environmental crisis that occurred at the end of the western Roman Empire. Recently, the problem has been critically reviewed by Calzolari (1996) and Squatriti (2010,

references therein). Highly anomalous rainfalls occurred at the beginning of the autumn of that year and were recorded by the Langobard Paul the Deacon (Paulus Diaconus, book III, chap. 23) as having hit most of Northern Italy and possibly central Italy as well, causing severe damage to human structures and to the landscape mainly owing to several landslides and floods. This tale was particularly interesting for geologists, thus originating an abundant, albeit repetitive, grey literature concerning the recognition of late-Holocene climatic deterioration LIA-like pulses and the related geomorphic effects, such as riverbed aggradation or incision phases (e.g. Veggiani, 1987, 1994). This kind of study saw Italy split into two main domains. In the northern domain, extending at least up to Florence (Nicosia et al., 2012), the paleoclimatic imprint was

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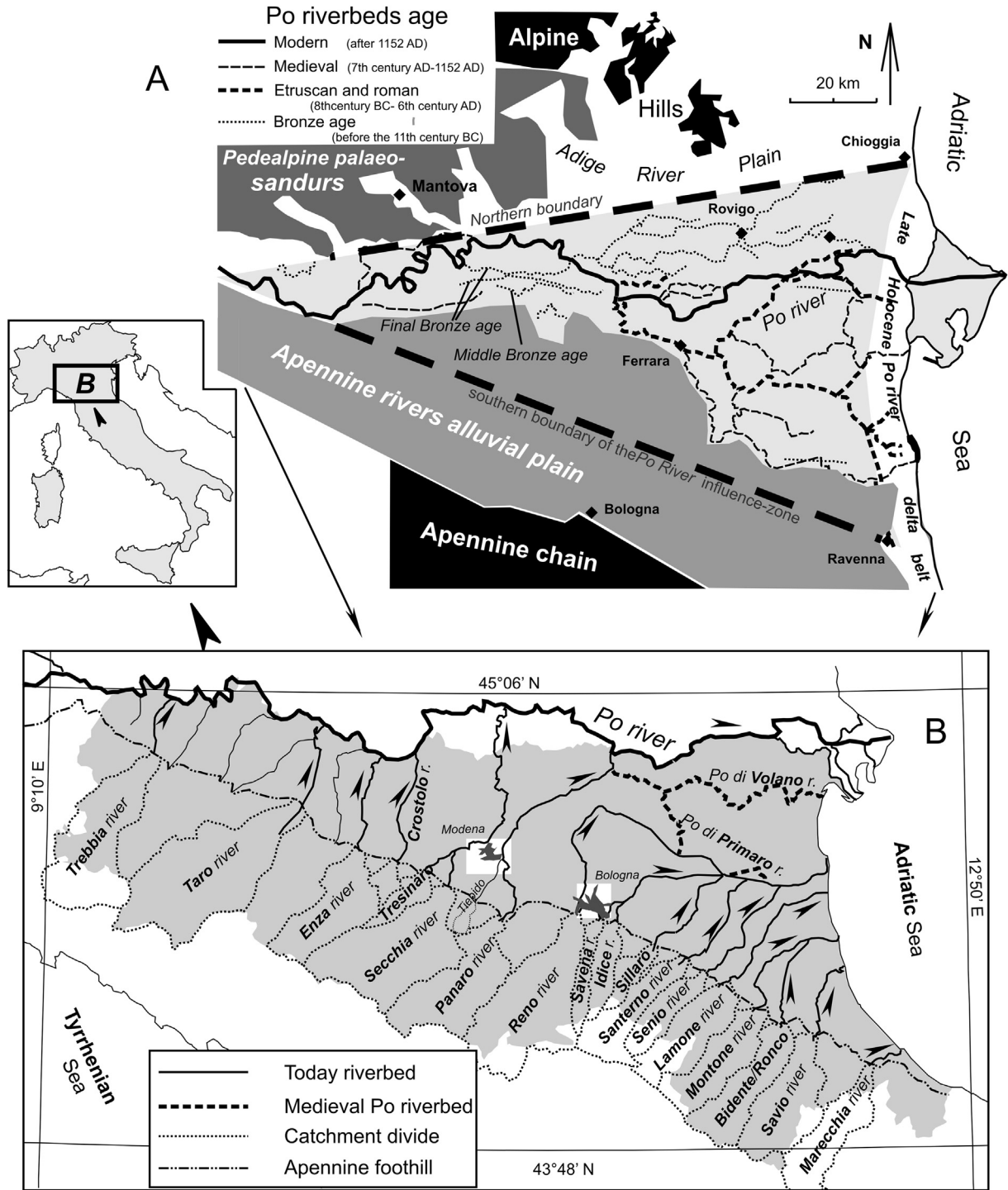


Fig. 1. The main river courses cited in the study are illustrated. A) The southern light-grey area includes the Apennine river domains, whereas the central white area shows the Po river domain (the dashed lines indicate the riverbeds ages). B) Present main rivers network and related mountain catchment areas. The two white rectangles in the Emilia-Romagna region show the location of Fig. 2.

thought to be probably prominent and preserved mainly in great alluvial plain areas (e.g. the Po river and its tributaries) due to the great availability of stratigraphic data. On the contrary, in the southern domain an anthropogenic origin of the valley river terrace aggradation was thought to be related to the ancient demographic pressure and land-use (Neboit, 1977, 1983; Brückner, 1986; Brown and Ellis, 1995). In more recent times, a new proposal (Ortolani and Pagliuca, 2000, 2007) suggested a climatic key also for the latter areas.

In the present study, a new series of evidence arising from archaeological surveys performed in the Modena and Bologna areas during the last twenty years by the *Soprintendenza per i Beni Archeologici dell'Emilia-Romagna* is reported. In particular, Modena was chosen due to the huge volume of available archaeostratigraphic data (Cardarelli et al., 1988a, 2001). The analysis of the new data seeks to show: i) the chronological constraints for the ancient natural sedimentation pattern; ii) the dominating driving factors (anthropogenic or climatic) of sediment delivery; and iii) physical

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