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From a river- to a man-dominated environment. Insights from the geo-archaeological record of Bologna (northern Italy)

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Mid-Late Holocene stratigraphy beneath the town of Bologna, in northern Italy, records an upward increase in the amount, thickness, width and connectivity of anthropogenic deposits and a parallel decrease in alluvial sediments. Anthropogenic deposits, spanning from the Neolithic to the Present, occur at three stratigraphic intervals separated by alluvial strata.

The lower interval, dated to the Neolithic-Early Eneolithic, includes sparse lithic, ceramic and copper artefacts, post holes, charcoals, shallow wells and ditches. These evidences of human presence are scattered along a pedogenized horizon developed during a phase of river stability lasting more than 3 millennia. Early Eneolithic rests are aligned along paleo river courses.

The second horizon consists of an uninterrupted archaeological sequence spanning from the Late Bronze Age to the Late Antiquity. Late Bronze and Iron Age remains include ceramic and metal artefacts, charcoals, huts, dwellings, wells, ditches, and cemetery sites. Iron age remains are pervasive and their distribution is irrespective of riverbed location. The elevated number of dwellings and cremation jars testifies to a significant local population growth. A dense grid of ditches and embankments denotes a widespread control of the drainage network. Roman deposits include large dwellings, public buildings, productive sites, wells, aqueducts, ditches, landfills, roads, bridges, cemetery sites. Romans introduced in the geological record huge amounts of anthropogenic materials with high preservation potential such as bricks and mortars. Large quantities of different rock types were imported from European and Mediterranean areas. These materials constitute a laterally continuous horizon buried at depth of 3-4 metres, which testifies to the development the colony of *Bononia*, founded in 189 BC. The amount and connectivity of roman rests, decreases away from the historical centre, where large farms, reclaimed lands and *centuriae* highlight an anthropogenically modified rural landscape. Fluvial gravels deposited since the Roman period are commonly enriched in brick clasts.

The uppermost anthropogenic interval is dated to the last millennia. Its base is a time-transgressive erosional surface which testifies to the progressive expansion of the Bologna urban area, with a minor pulse dated to Middle Ages (1200-1300 AD) and a major to the last 70 years. Particularly, in the 20th century the urban area of Bologna became 20 times larger and merged with adjacent villages. Post-1950 deposits are up-to-30 m thick and deeply cut into older stratigraphic units. Concrete, metal, and plastic are the most abundant materials. The last 70 years also record the spread of pollutants within shallow aquifers and dramatically increased

subsidence rates due to water withdrawal.

Anthropogenic deposits beneath Bologna record an overall upward transition from a river-dominated to a man-dominated environment. Iron Age and Roman deposits represent the first evidence of a landscape heavily modelled by human activities. However, the thickness, lateral extent and pervasiveness of post-1950 anthropogenic units support the recently proposed idea to place the base of the Anthropocene in the mid-20th century.