Lead pollution reveals the ancient history of Naples

Almost two thousand years after the eruption of Vesuvius that destroyed Pompeii and Herculaneum, certain periods of the history of Naples have just been reconstructed. Until now, historians and archaeologists had wondered about the impact of this volcanic eruption on the Aqua Augusta aqueduct which supplied Naples and neighboring cities with water. Recent geochemical analyses have made it possible to directly link the lead in the water pipes of the period with that trapped in the sediments of the old port of Naples. Results clearly show that the hydraulic network had been destroyed by the eruption of Vesuvius in AD 79 and that it took around fifteen years to replace it.

Fig. 1. View of the eruption of Vesuvius in 79 AD, from the bay of Naples, as imagined by the artist William Turner between 1817 and 1820. According to a multidisciplinary team of geoarchaeologists, archaeologists and geochemists, the eruption destroyed the water supply system in the bay of Naples. This mainly consisted of a stone aqueduct (the longest in the Roman world) completed by a dense network of lead pipes. It was replaced by a new system after around fifteen years of work.

During the construction of a new underground line, archaeological excavations were carried out in the ancient, long-buried port of Naples. They made it possible to study a six-meter thick deposit of sediment layers accumulated in the port over centuries. The geochemical analyses of these sedimentary deposits showed that the water of the port had been contaminated over the first six centuries AD with lead from the water circulation system of Naples and neighboring towns. This lead, which was the main component of the water pipes, dissolved into the water and spread into fountains and supply points before finally running into the port. Studying the isotopic composition of this element, i.e., the proportion of different lead isotopes in the sediments makes it possible to retrace events that took place two thousand years ago.

The analyses mainly revealed two distinct lead isotopes, before and after the eruption of Vesuvius in 79 AD. They prove that the vast water supply system of the bay of Naples was destroyed by the volcanic eruption and reconstructed using lead from one or more different mining areas. This sudden change in the lead signal, which occurred about fifteen years after the eruption, suggests that the Romans repaired the aqueduct and water pipes over a relatively short period of time.

Fig. 2. The archaeological excavation site in the ancient port of Naples is opposite the town square and a few meters below the present sea level. On the right, an example of a stratigraphic section sampled as part of the study. It is made up of muddy port sediments whose lead isotope

compositions reveal the Roman history of the town.
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This study also helps reconstruct the different phases of Naples' urban development in the 1st to 5th centuries AD. Lead is increasingly present in the sediments, suggesting an expansion of the hydraulic network or its intensification in the areas already supplied. From the beginning of the 5th century, however, the sediments are less contaminated, revealing that the water supply suffered further damage from barbarian invasions (the aqueduct was seized so as to cut off the town's water supply), new eruptions of Vesuvius in 472 and 512, epidemics or the city's economic and administrative collapse.

This interpretation of metal pollution in ancient port sediments, which makes it possible to retrace the history of a region, could be applied to other civilizations and geographical areas. In ongoing debates about the Anthropocene, this approach could provide new perspectives on the dynamics of human footprint on the environment.

Delile H
Maison de l'Orient et de la Méditerranée, Centre National de la Recherche Scientifique UMR 5133,
69365 Lyon Cedex 7, France
Department of Archaeology, University of Southampton, Southampton SO17 1BF, United Kingdom
Laboratoire de Géologie de Lyon, Ecole Normale Supérieure de Lyon, Université Claude Bernard-Lyon I,
Centre National de la Recherche Scientifique UMR 5276, 69007 Lyon, France

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