Using the geo-archaeological approach to explain past urban hazards

E. Fouache
University of Paris-Sorbonne, France
Senior Member of the HUF, France

ABSTRACT: The first cities emerged in the Middle East around the year 3000 BC. The geo-archaeological approach allows us to study environmental processes in an archaeological context and thus to identify the past urban hazards. There is much to be gained: these studies are fundamental to a better understanding of present-day hazards, to urban development, but also to remembering our heritage. Cities have always been susceptible to nature’s risks and natural disasters, but have also through urban development and through the close proximity of great numbers of human beings, thrown up their own hazards.

Keywords: city, hazards, geo-archaeology, archaeology, environment, urban development, heritage

1 INTRODUCTION

If we see the end of the process of neolithisation as being around the year 6000 BC in the Middle East first of all, then cities begin to appear after a long maturation period around 3000 BC. They sprung up on the banks of big rivers in Mesopotamia, in the areas that are now Iraq, Iran and Syria; and in the valleys of the River Nile, the River Jordan, the River Indus, the River Ganges and the Yellow River. The date of their emergence in Africa, Meso-America and South America is still disputed, but is definitely more recent. What distinguishes cities from villages or clusters of little farming towns is the concentration in a single area of economic, political, social and religious powers, which was reflected in a high relative concentration of non-farming populations and in a monumental administration often enclosed within a surrounding wall.

Geo-archaeology is an interdisciplinary approach that we define as being founded upon the use of methods and techniques drawn from geosciences, archaeology and geography, to recreate—in a multi-scalar, diachronic archaeological perspective—palaeoenvironments and landscape processes, in connection with human inhabitation (Fouache, 2010). The geo-archaeological approach allows us to comprehend, in an urban studies context, the evolution of environmental processes over the course of time, and the parallel evolution of the issues, the vagaries and thus the hazards of a city. Large modern-day developments—like the construction of an underground car-park in Lyon (Quai Saint Antoine), or the boring of tunnels in Istanbul (in the Yenikapi neighbourhood), going under the Golden Horn and the Bosphorus to link old Stamboul to the Asian side of the city—have resulted in a proliferation, where ancient cities once stood, of conservation-oriented archaeological excavations associated with environmental studies; in this instance the identification of the bed of the River Saône in the early Iron Age (http://fugundunumactus), and the excavation of a 10th–11th BC AD Byzantine port (Degremont, 2009). This is a major opportunity to bring together urban development, archaeology and history; and to encourage understanding of environmental processes amongst urban populations by integrating the notion of heritage into this understanding. This is of importance to the whole world, and especially to the world’s major cities.
Explaining the hazards of ancient cities can also serve as a great warning to the current generation, and promotes prevention policies rooted in a real understanding of the interaction between natural processes and processes brought about by human societies. We mustn’t, however, fall into any irrational fear of the risks of our environment. Between the Bronze Age in the Middle East, the Iron Age in Western Europe and the end of the modern era—to stick to a more archaeological than historical approach, examples of urban civilisations that have been destroyed solely by environmental disasters are rare.

2 CITIES AND CATAclysms

The greatest risk for cities of the past was, of course, today, a cataclysm: be it the direct effects of a natural catastrophe or the effects of society. The most notable kinds of such catastrophes have to be volcanic eruptions, earthquakes and tsunamis (Fouache, 2006). Numerous cities were rubbled off the map in this way. Pompeii, Herculaneum and Stabiae in Campania when Mount Vesuvius erupted in AD 79; Akrotiri in Santorini between 1635 and 1628 BC; and Helike taken by the Corinthian Gulf in 373 BC. The Lisbon earthquake of 1755, followed by a tsunami and the destruction of the city by the ensuing fire, is a good example of how urban development from human beings can heighten the consequences of a catastrophe. The Fukushima catastrophe is another in this long line. However, a city being erased from the map is somewhat exceptional; in the past as in the present, cities normally rise from the ashes in the same place, providing that the political and social systems dispose of sufficient resources to do so, and that the city is needed by the socio-economical, political and religious systems. It is due to these socio-economical, political and/or religious imperatives that the city is rebuilt in the same place, whether because of the site or because of the image of the city. A city’s exposure to ‘natural’ hazards is not, however, limited to cataclysms.

3 NON-Cataclysmics NATURAL HAZARDS

The frequent location of cities on the banks of rivers (Braudel and Magny, 2002) or by the sea puts them at the mercy of drastic rises in water levels, floods and changing shorelines (Morehange et al., 2007). The original site of the city is often sheltered from these dangers on a headland or hill, but as soon as the city has been established, a lower city, suburbs and a port, which are exposed, all come into existence; then, very soon after, urban growth spreads into at-risk areas, the original site being too small. An example of this is the town of Sommières in the Gard department (France), built at the foot of the hill on which the castle stands, right on the River Vidourle flood plain despite the high frequency of floods originating in the Cevennes ranges. The adoption of collective risk-management measures can be a factor in social acceptance of the hazard. Thus the Ancient Egyptians viewed the floods of the Nile as a nourishment of the land, and the Venetians very quickly learnt to live with the phenomenon of Acqua Alta.

Indeed, the site chosen can itself be the cause of a city’s wealth. The ancient city of Mari (Marqueterre, 2004) on the Middle Euphrates in modern-day Syria was closely linked to the river, its irrigated farmland and its waterway. Throughout the third and second centuries BC, these advantages enabled costly development that the Sumerian civilisation in Uruk had the human and financial resources to support. The surrounding wall of the Mari palace can thus just as easily be viewed as a fortification as it can be a dyke. The same is true for Babylon on the River Tigris: from the late 17th to the 11th century BC, Babylonian kings were incessantly obliged to raise their ramparts, nearly 20 m in total, to fight the frequent aggradation of the river. At the end, it wasn’t the river’s water levels that did for Babylon, but a Median invasion.

What geo-archaeological studies also teach us, as well as the studies of paleo-climatologists, is that at the level of the Holocene (Mayewski et al., 2004) — the last 10,000 years — environmental processes have varied: the seasonal distribution of weather types, temperatures (by a yearly average of roughly two degrees), rainfall (by irregular amounts) (Birk et al., 2005); the consequences of all of this are heightened all the more in remote areas of the inhabited world. As a result, the morphogenesis and the hydrological rhythms of rivers and thus the hydro-morphological hazards have evolved (Amaud-Fauvet, 2000, 2008), between calm periods such as the Medieval Warm Period, and other periods witnessing far more exceptional occurrences, such as the Little Ice Age. In the same time period, the changes societies have brought to the exploitation of drainage basins have interacted with these natural processes, sometimes worsening environmental disasters, sometimes balancing them out (Diamond, 2000). This is how — due to rising linked to the agricultural exploitation of its hinterlands and the progradation of the Kujík Mésaoré Delta, the city of Ephesos ended up ceasing to be a port (Kraft et al., 2007). However, cities do not merely suffer their environment, they affect it themselves.

4 THE IMPACT OF CITIES ON THEIR ENVIRONMENT

From the very beginning of its life, a city has a considerable impact on its environment. Huge numbers of inhabitants — Xi’an, for example, in the Chinese province of Shaanxi, is believed to have been the home of over a million people in 1000 BC — have always been conducive to epidemics (Huys, 2005), pollution (Botos et al., 2003), and a heightened consumption of energy and natural resources. The supposed plague — more probably a typhus epidemic — that hit Athens from 430 to 427 BC is still remembered today. Such paleoepidemics appear in geo-archaeological in the study of intra-site sediments, or that of sedimentary archives in ancient port basins and lake and river sediments found downstream from cities. Thus geo-archaeologists use levels of lead, scoria and heavy metals to trace and mark out the past, the study of skeletons in necropoleis offers a glimpse of the health of an ancient population and the impact of chronic illnesses and epidemics. The most finely developed ancient urban societies took measures against some of these risks, as far as the knowledge of their era allowed them to. One needs look no further than supplies of clean drinking water; fountains urban water tanks; gladium networks (Buasti, 2001) — which became commonplace across the Iberian plateau and beyond in the first millennium BC, — or Roman aqueducts (Bonni, 1983) waste disposal and wastewater disposal; the establishment of cemeteries outside of the city; regulation aiming to curb the risk of fire; parasitic construction practices; the building of dykes and levees; or the confinement of polluting activities or industries, for example tanneries situated in their own specific neighbourhoods. We must be careful, however, not to apply modern standards of safety and responsibility to ancient urban societies.

5 THE NEW RESPONSIBILITY OF CONTEMPORARY URBAN SOCIETIES

In an epidemiological as well as an environmental sense, there is most definitely a difference in size between ancient and modern urban societies. Our civilisation — with its knowledge of topocentric place theory and its vast advances in geosciences and biology, — is the first to have gained a scientific understanding of the genesis of volcanic eruptions, earthquakes, tsunamis and landslides, as well as of the environmental disasters or health crises of the past, and the first to have conceived of forecasting such phenomena. Considering current scientific and technological expertise, preventing major and natural hazards should be a top priority for cities all over the world, based on a five-point plan: studying dangers, knowing what it is stake, defining risks, adopting urban planning regulations, and educating city-dwellers on the states of crisis specific to each urban context. Be it due to a lack of specialists, a lack of resources, an absence of political will, corruption, or misunderstanding financial interests, such a plan is still a rare exception in the world today.

6 WHAT CAUSES A CITY TO DISAPPEAR?

Seeing as cities are each suited on areas with their own topography, with site constraints and hazards linked to these dangers, they are in essence social, economical, religious and political...
products. By way of proof, all cities, throughout history, have been created either by a myth or by a decree. In the Middle East, the first cities to be recognised and partially explored were, obviously, new cities (Margaloni, 2004), clearly built by political will. Later on, foundations were in fact often found to be hiding refoundations, and the desire of authority to forever lave its mark on history. The city of Kart-Tukulti-Ninurta (Eckhoff, 2005), is emblematic in this sense: situated on the right bank of the River Tigris, where modern-day Iraq stands, it was founded in such a way by King Tukulti Ninurta I, who ruled from 1244 to 1208 BC. This veritable new city boasted a design based on quadrilateral, long orchard paths and baked-brick ramparts. The king wanted it to be a new capital, but he died before it was finished, and the city soon crumbled.

What archaeology teaches us is that cities disappear with the civilisations that founded them, for reasons often far more social, political or religious than environmental. The aridification of the global climate (Kazazoglou and Marro, 2007; Fouache et al., 2009) that followed the Holocene Climate Optimum is often put forward as the reason behind the great cultural crises that occurred in the Near East, such as the fall of the Akkad Empire (Wells et al., 1993) in the Arabo-Persian Gulf, or the abandonment of Harappan cities in the Indus Valley. This aridification was most probably caused either by thousand- or hundred-year fluctuations, by some sudden turn of events, or by a progressive evolution of the climate towards dryness, connected with the waning of the Indian monsoons (Lézine et al., 2007). Pollen and spillettems analyses in the region do show that this waning of the Indian monsoons from 4700 to 4200 BP (Ivory and Lézine), was very real, but an actual link with the collapse of late Bronze Age civilisations is not certain.

When we discuss the collapse of Bronze Age civilisations in the Near and Middle East, we thus must take care to distinguish vast urban centres—economic, political and cultural hubs, very dependent on external flows, and, as we have intimated, very quickly abandoned at the end of the third millennium BCE, and little urban and rural sites like those, for example, of the Sabzevar region (Fouache et al., 2010) in Iran, which have been occupied consistently throughout their existence. One must also consider the influence of aridification, which is by no means a quick and brutal process, but rather a slow evolution over the course of 600 years. To attribute the collapse of these Bronze Age civilisations to the only climate factor is in question seems, in the light of current archaeological knowledge, a gross simplification.

If we move to Central Asia, and prehistoric Central Asia, recent archeo-environmental research (Cattani, 2005; Francfort, 2005; Francfort, 2009; Francfort and Tremblay, 2010; Lamboiu, 2010) seems to be showing us that the pinnacle of Oxus civilisation came at the end of this phase of aridification, proven by environmental studies (Cremaschi, 1998), notably the advance of the Kara-Kum dunes and the parallel southerly advance of steppe peoples (Cattani, 2005); its collapse, meanwhile, most likely came with the beginning of a new humid phase.

7 CONCLUSION

We are fortunate to be able to use conservation-oriented archaeological digs to carry out, within a dense urban tissue, geo-archaeological studies of environmental processes. This affords us a better understanding of initial site constraints, and allows us to piece together the dynamic evolution of environmental constraints which interacted with processes begetten by human development. This piecing together in turn affords us a better understanding of the personal or random nature of hazards, lets us know when they will recur, and allows us to form more effective prevention policies. This environmental history can also form part of a city’s heritage, a part that can be exhibited for all to see and by placing a city’s current situation in a dual history, that of the environment and that of human societies—can be used for educational purposes in explaining the nature of hazards and the evolution of issues and risks. We must not, however, focus exclusively on environmental risks to our cities. Preventing major hazards, reducing pollutants and managing waste, optimising the management of water resources, and harnessing the growth of megalopolises are all major issues—but due to the huge numbers of inhabitants and their increasing concentration, the greatest dangers to the long lives of our cities are actually, now as they always have been, social and political.

ACKNOWLEDGEMENTS

I am most particularly indebted in the preparation of this article to Annie Caubet, the honorary General Curator of the Louvre Museum, for her remarks and suggestions on Middle Eastern cities and Joe Cunningham for translation.

REFERENCES


Fouache, E., Cosandey, C., Francfort, H.P., Rendzio-Sarmiento, J. Vabhati, A.A., Lhuillier, J. 2010. The Horn of Sabzevar and regional water resources from the Bronze Age to the present day (Northeastern Iran). Geoecmimia Asia, 2/5, 6, p. 287-294.


