Tracking mass death during the fall of Rome's empire (I)

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This is the first part of a two-part article; the second, "A first inventory of mass graves from late antiquity", will appear in *JRA* 29 (2016) as well as on the CJO website.

The Roman empire was more than a system of institutions, beliefs and socio-economic structures; it was a concentration of human capital, physically located in the demographic strength of the population. Human health and mortality crucially affected, and reflected, the economy. As less optimistic interpretations of Late Roman history regain traction, it becomes important to find ways to test such interpretations, including their biological manifestations and implications. One approach would be to map over time and space large-scale violence and disease-driven surges in mortality, as well as chronic factors that may have more gradually eroded the empire's human capital. Biomolecular archaeology and pathogen genetics are sparking novel explorations of ancient diseases, which ranged from the spectacularly acute to the chronic — malaria, leprosy or tuberculosis —, not to mention seasonal spikes in more routine gastrointestinal infections and the like. Individually and especially cumulatively, the impact of acute and chronic factors could have been of considerable magnitude.[1] The same is true for environmental conditions; thanks to the advances of paleoclimate science, we now know that they too varied unexpectedly, and surely could affect population health.[2]

Whatever their origin, the sharpest mortality challenges had the capacity suddenly to shock the "system" — the network of interacting and interdependent communities that composed the empire and its neighbors. Some crises killed large numbers of people quickly: invasions, battles, famines, epidemics, and natural disasters, such as the Mediter-

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1 Chronic infections contributed to the health load borne by ancient society; they probably varied according to broader economic and environmental trends and may preserve signals of those trends. See the pioneering study of seasonal mortality by B. D. Shaw, "Seasons of death: aspects of mortality in imperial Rome," *JRS* 86 (1996) 100-38. A positive result for the ancient DNA of *Plasmodium falciparum* (malaria) from the remains of Late Roman children was reported by R. Sallares, *Malaria and Rome. A history of malaria in ancient Italy* (Oxford 2002) 68, and, on its contribution as an underlying factor in mortality, ibid. 116-17. For leprosy, see V. J. Schuenemann *et al.*, "Genome-wide comparison of medieval and modern *Mycobacterium leprae*," *Science* 341 (2013) 179-83. For tuberculosis in mediaeval individuals, see A. M. Gernaey *et al.*, "Mycolic acids and ancient DNA confirm an osteological diagnosis of tuberculosis," *Tuberculosis* 81.4 (Edinburgh 2001) 259-65; cf. I. Hershkovitz *et al.*, "Detection and molecular characterization of 9,000-year-old *Mycobacterium tuberculosis* from a Neolithic settlement in the Eastern Mediterranean," *Public Library of Science One* 3.10 (2008) e3426; for a new method, see J. E. Redman *et al.*, "Mycocerosic acid biomarkers for the diagnosis of tuberculosis in the Coimbra skeletal collection," *Tuberculosis* 89 (2009) 267-77. For the overall relation of population health and economic trends, see M. McCormick, *Origins of the European economy: communications and commerce, A.D. 300-900* (Cambridge 2001) 38-41.

2 M. McCormick *et al.*, "Climate change during and after the Roman Empire and its successors: reconstructing the past from scientific and historical evidence," *J. Interdisc. Hist.* 43 (2012) 169-220; id., "What climate science, Ausonius, Nile floods, rye, and thatch tell us about the environmental history of the Roman Empire," in W. V. Harris (ed.), *The ancient Mediterranean environment between science and history* (New York 2013) 61-88; J. Haldon *et al.*, "The climate and environment of Byzantine Anatolia: integrating science, history, and archaeology," *J. Interdisc. Hist.* 45 (2014) 113-61.