Black death: How we solved the centuries-old mystery of its origins

June 21 2022, by Philip Slavin

Tombstones investigated in new research, most from 1338. Credit: P.-G. Borbone/Nature, Author provided

It is not an exaggeration to say that the question of where and when the Black Death, the deadliest pandemic ever, originated is one of the biggest mysteries in human history. After all, the Black Death was the first wave of the second plague pandemic of the 14th to early 19th centuries. It killed some 50–60% of the population in Europe, the Middle East and North Africa and an unaccountable number of people in Central Asia.

Different proposals, based on competing theories, have been put forward. But in 2017, I came across some records describing an intriguing medieval cemetery in Kara-Djigach, Chüy Valley, northern Kyrgyzstan, which I suspected may hold the key. As part of a multidisciplinary team co-led by Maria Spyrou at University of Tubingen, we have now investigated several specimens from individuals buried at that site—and come up with an answer.

The idea that the Black Death originated in the east—territories overlapping, roughly speaking, Central Asia, Mongolia and China—dates back to the contemporaries of the pandemic in Europe and the Islamic world. The modern, academic Chinese origin theory dates back to at least 1756–58 and a publication about the history of Central Asia by French scholar Joseph de Guignes.

Other plague historians see Central Asia in general, and the Tian-Shan region, a mountain area on the border between China and Kyrgyzstan, as the Black Death's cradle. But some scholars have argued for alternative regions as diverse as northern Iraq, the Caucasus, Russia's Volga, western Urals or western Siberia, the Gobi desert and India. One historian even suggested that the Black Death beginnings was associated with some unknown cosmic event.

Similarly, the chronological origins of the pandemic have been disputed too. In a 2013 study, a team of microbiologists identified a major

evolutionary event in which the main plague lineage (Branch 0) mutated and split into four new plague lineages: Branches 1–4. Dubbed the "Great Polytomy" or "Big Bang," the researchers found that this event created the strain (on Branch 1), associated with the Black Death. The research, which was based on probability computations, dated this event to a period between 1142 and 1339. They also inferred that *Y. pestis* —plague bacterium—may have originated in the Tibetan-Qinghai Plateau in Asia.

Drawing on this work, it has been suggested that that the pandemic may have spread widely in the 13th century, thanks to the expansion of the emerging Mongol Empire.

Tian Shan region. Credit: Lyazzat Musralina,, Author provided

Genetics to the rescue

Without securely dated ancient DNA from Central Asia, however, the question would ultimately remain unsolved.

This changed when I came across records of the Kara-Djigach cemetery—excavated by the Russian archaeologist Nikolai Pantusov in 1885 and 1886 and analyzed by the Russian scholar Daniel Chwolson (1819–1911). Of the total 467 stones, covering the period 1248–1345, 118 are dated to 1338—a suspiciously large proportions of deaths. Most most of the stones have little detail about the person they commemorate, just bearing the names and death dates, but there are ten longer inscriptions from those years, stating "pestilence" (mawtānā in Syriac, the language of ancient Syria) as a cause of death.

It was intriguing. Not only that "pestilence" was mentioned, but that the associated tombstones were all dated to 1338–39—just seven to eight years before the arrival of the Black Death in Crimea, and its subsequent spread all over west Eurasia and north Africa. I had a strong gut feeling about the likely connection.

We therefore decided to genetically sequence the remains from several specimens from these plague year burials, and managed to get results from the teeth of seven different individuals. Our analysis detected the presence of *Y. pestis* in three specimens, thus confirming that pestilence was indeed caused by this bacterium. We also noted that the strain (on Branch 0) seemed to have just preceded the Great Polytomy, out of which the Black Death strain emerged shortly after. The study therefore indicates that the Black Death commenced shortly after (or possibly even during) this 1338–39 outbreak.

Of course, there is nothing to suggest that that Kara-Djigach was the specific source of the pandemic. Rather, we believe that the disaster started somewhere in the wider Tian Shan area, perhaps not too far from that site. It is important to bear in mind that *Y. pestis* is a bacterium that lives among wild rodent populations. We often associate plague with rats. But in Tian Shan, the prevalent rodent carriers of plague are marmots. It is therefore likely that it was their colonies that were the ultimate source of the 1338–39 outbreak.

Importantly, ancient plague strains found today in marmot colonies in Tian Shan plague reservoirs are evolutionarily even older than the Kara-Djigach strain. Therefore, we conclude that the Kara-Djigach strain must have evolved locally in marmot colonies within the extended Tian Shan region, rather than being introduced into the Kara-Djigach community from some faraway origin. At some point, the bacteria simply crossed over to human inhabitants of the region.

The publication in question has ended the centuries-old debate regarding the spatio-temporal origins of the Black Death. But what else do we take from it? To understand the phenomenon of emerging epidemic diseases, it is essential to have a big evolutionary picture. It is important to see how these diseases develop evolutionary and historically, and avoid treating different strains as isolated phenomena. To understand how the diseases develop and get transmitted, it is also crucial to consider the environmental and socioeconomic contexts.

We also hope that our study will set an example to other historians and scientists that hope to answer such big questions—showing that a collaborative approach involving colleagues from different fields and bringing together different skills, methods, experiences and talents, is the future of historical and paleogenetic research.

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