Food trade with South Asia revealed by Near East food remains

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Excavation of Megiddo (Area K). Credit: the Meggido Expedition

Exotic Asian spices such as turmeric and fruits like the banana had already reached the Mediterranean more than 3000 years ago, much earlier than previously thought. A team of researchers working alongside archaeologist Philipp Stockhammer at Ludwig-Maximilians-Universität in Munich (LMU) has shown that even in the Bronze Age, long-distance trade in food was already connecting distant societies.

Imagine this scene from a market in the city of Megiddo in the Levant 3700 years ago: The market traders are hawking not only wheat, millet or dates, which grow throughout the region, but also carafes of sesame oil and bowls of a bright yellow spice that has recently appeared among their wares. This is how Philipp Stockhammer imagines the bustle of the Bronze Age market in the eastern Mediterranean.

Working with an international team to analyze food residues in tooth tartar, the LMU archaeologist has found evidence that people in the Levant were already eating turmeric, bananas and even soy in the Bronze and Early Iron Ages. "Exotic spices, fruits and oils from Asia had thus reached the Mediterranean several centuries, in some cases even millennia, earlier than had been previously thought," says Stockhammer. "This is the earliest direct evidence to date of turmeric, banana and soy outside of South and East Asia."

It is also direct evidence that as early as the second millennium BCE there was already a flourishing long-distance trade in exotic fruits, spices and oils, which is believed to have connected South Asia and the Levant via Mesopotamia or Egypt. While substantial trade across these regions is amply documented later on, tracing the roots of this nascent globalization has proved to be a stubborn problem. The findings of this study confirm that long-distance trade in culinary goods has connected these distant societies since at least the Bronze Age. People obviously had a great interest in exotic foods from very early on.

For their analyses, Stockhammer's international team examined 16 individuals from the Megiddo and Tel Erani excavations, which are located in present-day Israel. The region in the southern Levant served as an important bridge between the Mediterranean, Asia and Egypt in the 2nd millennium BCE. The aim of the research was to investigate the cuisines of Bronze Age Levantine populations by analyzing traces of food remnants, including ancient proteins and plant microfossils, that

have remained preserved in human dental calculus over thousands of years.

The human mouth is full of bacteria, which continually petrify and form calculus. Tiny food particles become entrapped and preserved in the growing calculus, and it is these minute remnants that can now be accessed for scientific research thanks to cutting-edge methods. For the purposes of their analysis, the researchers took samples from a variety of individuals at the Bronze Age site of Megiddo and the Early Iron Age site of Tel Erani. They analyzed which food proteins and plant residues were preserved in the calculus on their teeth. "This enables us to find traces of what a person ate," says Stockhammer. "Anyone who does not practice good dental hygiene will still be telling us archaeologists what they have been eating thousands of years from now."

3D reconstruction of Grave 50 from Megiddo (Area H). Credit: the Meggido Expedition

Palaeoproteomics is the name of this growing new field of research. The method could develop into a standard procedure in archaeology, or so the researchers hope. "Our high-resolution study of ancient proteins and plant residues from human dental calculus is the first of its kind to study the cuisines of the ancient Near East," says Christina Warinner, a molecular archaeologist at Harvard University and the Max Planck Institute for the Science of Human History and co-senior author of the

article. "Our research demonstrates the great potential of these methods to detect foods that otherwise leave few archaeological traces. Dental calculus is such a valuable source of information about the lives of ancient peoples."

"Our approach breaks new scientific ground," explains LMU biochemist and lead author Ashley Scott. That is because assigning individual protein remnants to specific foodstuffs is no small task. Beyond the painstaking work of identification, the protein itself must also survive for thousands of years. "Interestingly, we find that allergy-associated proteins appear to be the most stable in human calculus", says Scott, a finding she believes may be due to the known thermostability of many allergens. For instance, the researchers were able to detect wheat via wheat gluten proteins, says Stockhammer. The team was then able to independently confirm the presence of wheat using a type of plant microfossil known as phytoliths. Phytoliths were also used to identify millet and date palm in the Levant during the Bronze and Iron Ages, but phytoliths are not abundant or even present in many foods, which is why the new protein findings are so groundbreaking—paleoproteomics enables the identification of foods that have left few other traces, such as sesame. Sesame proteins were identified in dental calculus from both Megiddo and Tel Erani. "This suggests that sesame had become a staple food in the Levant by the 2nd millennium BCE," says Stockhammer.

Two additional protein findings are particularly remarkable, explains Stockhammer. In one individual's dental calculus from Megiddo, turmeric and soy proteins were found, while in another individual from Tel Erani banana proteins were identified. All three foods are likely to have reached the Levant via South Asia. Bananas were originally domesticated in Southeast Asia, where they had been used since the 5th millennium BCE, and they arrived in West Africa 4000 years later, but little is known about their intervening trade or use. "Our analyses thus provide crucial information on the spread of the banana around the

world. No archaeological or written evidence had previously suggested such an early spread into the Mediterranean region," says Stockhammer, although the sudden appearance of banana in West Africa just a few centuries later has hinted that such a trade might have existed. "I find it spectacular that food was exchanged over long distances at such an early point in history."

Stockhammer notes that they cannot rule out the possibility, of course, that one of the individuals spent part of their life in South Asia and consumed the corresponding food only while they were there. Even if the extent to which spices, oils and fruits were imported is not yet known, there is much to indicate that trade was indeed taking place, since there is also other evidence of exotic spices in the Eastern Mediterranean—Pharaoh Ramses II was buried with peppercorns from India in 1213 BCE. They were found in his nose.

The results of the study have been published in the journal *PNAS*.

The work is part of Stockhammer's project "FoodTransforms—Transformations of Food in the Eastern Mediterranean Late Bronze Age," which is funded by the European Research Council. The international team that produced the study encompasses scientists from LMU Munich, Harvard University and the Max Planck Institute for the Science of Human History in Jena. The fundamental question behind his project—and thus the starting point for the current study—was to clarify whether the early globalization of trade networks in the Bronze Age also concerned food.

"In fact, we can now grasp the impact of globalization during the second millennium BCE on East Mediterranean cuisine," says Stockhammer. "Mediterranean cuisine was characterized by intercultural exchange from an early stage."

More information: Ashley Scott el al., "Exotic foods reveal contact between South Asia and the Near East during the second millennium BCE," *PNAS* (2020). www.pnas.org/cgi/doi/10.1073/pnas.2014956117

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