

## Podcast interview: Heather McKillop

**PNAS:** Welcome to Science Sessions. I'm Paul Gabrielsen. From the forests of Central America to the archipelagos of Southeast Asia, human civilizations have built industries around salt. Salt is an essential human nutrient, and both ancient and modern people have met the need by setting up salt kitchens. These kitchens are small structures designed around concentrating brines and drying salt cakes. The Maya civilization is no exception. Archaeologist Heather McKillop of Louisiana State University is a veteran of excavating Maya sites in Belize. In one of these sites, a complex of salt kitchens called the Paynes Creek Salt Works, she and her colleagues found stone tools that, on later analysis, revealed a surprising use. The results, reported in a recent PNAS paper, helped McKillop better understand the economics of how salt may have been distributed from seaside villages to inland areas of the Maya empire.

McKillop tells the story of the discovery of the Paynes Creek site in a mangrove swamp.

**McKillop:** So, I had a sabbatical in 2004, and this is really when I started to focus on the Paynes Creek Salt Works. And we were walking in the water, and we were finding sites. And at site 15 we kept finding wood, sort of sticking out of the seafloor a little bit. But the thing is, wood is not supposed to preserve in the tropical rainforest. It decays. Finally I said, "Okay, we're going to excavate one of these pieces of wood. If it's a post, it's going to be straight and it's going to be sharpened at the end." I lifted it up about a meter above the water. This straight piece of wood clearly had a sharpened end at the bottom. We started looking around and found some more posts, and it seemed to form kind of a rectangular shape. My team said "What is it?" And I said, "Well, it's a salt kitchen." And so, it was a building that was dedicated to boiling brine in pots over fires to make salt and sometimes to harden it into salt cakes.

**PNAS:** The team eventually found 110 salt kitchen structures at the Paynes Creek Salt Works, along with stone tools. They assumed, because of the abundance of wooden posts, that the tools had been used to cut and shape the wood. McKillop contacted Kazuo Aoyama of Ibaraki University in Japan. He's an expert in interpreting the patterns of wear in stone tools. She brought him the samples at a conference, and he reported back his findings.

**McKillop:** Only a minority of the stone tools were used for woodworking. Most of them were used for multipurpose things. The majority of the stone tools were used for cutting fish or meat, and/or for scraping hides or scaling fish. We had no suspicion that they were doing anything with fish. The mangrove peat is wonderful for preserving wood and other plant remains, but it's very acidic and so it actually eats away at the bone, shell. If they were fishing or if they had fish there, normally it wouldn't be preserved. But clearly there was a lot of processing of fish going on.

**PNAS:** The results suggested that in addition to producing salt, the people of Paynes Creek were likely also salting fish.

**McKillop:** If you also add salted fish to the sequence, then you have got not just dietary salt but you've got a protein, and a protein food resource that can be stored; and so, the ability to store food for lean times. You could use this as risk management. And also, then take it to market when you might be able to get more for your salted fish and your salt cakes at the marketplace because there's a greater demand, a demand throughout the year. Some of my colleagues working in the Maya area have suggested that fish was salted and traded inland, but how do you build up a picture to support that when bones often aren't preserved at Maya sites? But I think that's the kind of argument that we're trying to build up with the Paynes Creek Salt Works to figure out what was the economy, what was the buy and sell or what was the trade that was going on.

**PNAS:** McKillop says the results expand our understanding of the Maya economy of salt.

**McKillop:** There were probably a lot of intensive salt production facilities along the coast of Belize where wood hasn't preserved. And we also have an infrastructure of distribution, because we have a canoe, we've got one 4'7" wooden canoe paddle. They were making it as salt cakes, as standardized units, they were salting fish as well, and trading it, and they were taking these commodities to marketplaces, and they were getting things in exchange. We do have pottery from inland areas, and we have stone tools, and we have other materials. You've basically got a system of the regional production and distribution of salt, and salted fish in some cases, as part of this marketplace economy. And so, it builds a picture, at least to me, that regional production and trade, through the marketplace, was a significant part of the Maya economy, and it was based on surplus household production. So, family businesses.

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