

limb amputations, and renal failure. And they are screening DNA samples collected from their 46,000 subjects to see if Chinese have a genetic susceptibility to diabetes.

The droves of undiagnosed diabetes cases point to a fundamental weakness in China's health care system. Clinics and hospitals "are not set up to identify people with the precursors to diabetes. They don't routinely test people, even people who might have a history of diabetes in the family," says Brian Oldenburg, a public health specialist who heads the Initiative for Global Health Improvement at Monash University in Melbourne, Australia. Oldenburg, who is advising Beijing health officials on how to reduce the diabetes burden, says it will be critical to identify people at risk and get them into programs to modify their behavior. The challenge, he says, is to "reorient a health system focused on child and maternal health and infectious diseases to help people manage a chronic disease like diabetes."

Improving disease prevention will take new regulations, awareness campaigns, and leadership by health care professionals, says Lincoln Chen. The China Medical Board has a program to urge doctors to stop smoking and adopt and enforce no-smoking rules in hospitals and clinics. Yang Gonghuan wants the food industry to cut back on salt as part of a broader effort to rein in hypertension. And to battle diabetes, Chen Yan, who heads the Institute for Nutritional Sciences, says he and others are lobbying the government and industry to fortify milk products with vitamin D. Recent studies have found that more than 90% of middle-aged and older people in Beijing and Shanghai suffer vitamin D deficiency, which exacerbates diabetes and prediabetes.

The central government is tuning in to the shifting disease burden. In spring 2009, the State Council adopted sweeping health care reforms that aim primarily to broaden coverage and improve delivery. The plan also calls for hepatitis B vaccinations to stave off liver cancer and breast and cervical cancer screening. "It's a start," says Yang Gonghuan, who argues that greater emphasis should be placed on tobacco control and tackling stroke and heart disease.

China was caught off-guard by an "onslaught of chronic and noncommunicable diseases," says Lincoln Chen. "I have no doubt that the Chinese will respond as recognition mounts and as health care costs mount, but how quickly and how effectively they can respond is not known," he says. The key may be teaching a lesson that many Westerners are only beginning to fathom: The "good life," without moderation, can be bad for one's health. —DENNIS NORMILE



## ARCHAEOLOGY

## Unprecedented Excavation Brings Maritime Silk Road to Life

Raising the medieval *Nanhai 1* wreck was a technical tour de force; now archaeologists are preparing to take the vessel apart plank by plank

**HAILING ISLAND, CHINA**—In 1987, treasure hunters searching for a 16th century shipwreck off the coast of southern China stumbled instead upon relics from a much older merchant vessel. The serendipitous find "confirmed the existence of an ancient maritime trade route linking China and the West," says Zhang Wanxing, vice director of Guangdong Maritime Silk Road Museum here. In an unprecedented feat 20 years later, the 30-meter-long, 10-meter-wide ship, called *Nanhai 1*, or *South China Sea 1*, was scooped up along with a thick blanket of silt that entombs and preserves it, and hauled en masse to the museum. Now, at long last, archaeologists are about to embark on the next stage of *Nanhai 1*'s journey: a plank-by-plank excavation that will recover upward of 80,000 artifacts nestled inside.

A preliminary excavation last autumn lifted the veil on medieval Chinese shipbuilding, whetting appetites for more. The next phase will be "the first systematic and comprehensive study of a maritime silk route ship and its cargo," says archaeologist Bill Jeffery of James Cook University in Queensland, Australia. "Nothing like it has ever been done before anywhere in the world."

Chinese merchant vessels plied the Maritime Silk Road, from about the 2nd century B.C.E. to the 18th century C.E., starting out

from ports along China's southeast coast and making for lands as far away as India and the Middle East. A handful of wrecks from the period had yielded precious few artifacts—until *Nanhai 1*, which promises to shed light on everything from navigation and shipbuilding to porcelain making and metalwork, says Wei Jun, vice director of Guangdong Cultural Relics Bureau. And as *Science* went to press, salvage archaeologists were about to commence recovery of relics from another Silk Road-era wreck, *Nan'ao 1*, off the coast of Guangdong.

*Nanhai 1*'s serendipitous recovery began in the summer of 1987, when Guangzhou Salvage Bureau of the Chinese Ministry of Communications and Maritime Exploration and Recovery Ltd. were searching for the *Yhrhynsburg*, an East India Company vessel known to have sunk near the Chuanshan Archipelago in the South China Sea, off the coast of Guangdong Province. Scouring the seabed, the treasure hunters made an intriguing discovery: green porcelain bowls and other relics that were at least 800 years old. Chinese officials immediately halted the operation and called in archaeologists. The relics pegged the wreck to the Song Dynasty, which lasted from 960 C.E. to 1279 C.E. Archaeologists were especially astonished by a 1.7-meter-long golden belt that was like

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## SILK ROAD OF THE SEA



**Westward bound.** Now moored in mud in a museum, *Nanhai 1* (left) is one of two major wrecks from the Maritime Silk Road.

nothing they had seen before. “The ornamentation was totally different” from anything else made in China at the time, says Zhang Wanxing. “Everybody was shocked and excited,” adds Cui Yong, vice director of the Underwater Archeology Research Center of the Guangdong Provincial Institute of Cultural Relics and Archaeology.

The first formal underwater excavation began in 1989. Zhang Wei, director of the National Underwater Team and vice director of the National Museum of China, found a wooden block—perhaps part of a mast—and a second diver found a fragment of porcelain. Those were the only two items recovered by divers until 2001, when an excavation sponsored by the Hong Kong China Underwater Archaeology Research and Exploration Association netted more than 6000 objects, including ceramics, coins, and metalwork. From 2002 to 2004, a \$5.9 million program undertaken by the National Museum of China used radar soundings to map out *Nanhai 1* and confirmed the excellent condition it appeared to be in.

A huge decision confronted the experts: whether to excavate *Nanhai 1* where it lay or haul it ashore first. One other wreck had been raised intact successfully: the *Vasa*, a 17th century Swedish warship that was lifted from the bottom of Stockholm harbor in 1961 (*Science*, 12 September 2003, p. 1459). But *Vasa* was a special case: The harbor’s frigid, less saline waters had shielded its hull from marine worms that devour wood. *Nanhai 1* was saved by silt that had quickly engulfed it.

On a visit to China in 2004, George Bass of the Institute of Nautical Archaeology (INA) in College Station, Texas,

widely considered the father of marine archaeology, recommended that *Nanhai 1* be excavated like almost all other wrecks have been: by disassembling it on the seabed. Zhang Wei agreed, envisioning a 2-year-long in situ excavation. But in 2005 an expert panel organized by the National Heritage Board of China opted instead for a more ambitious plan proposed by the Guangdong government.

The \$13 million salvage operation, using a 530-ton steel container specially designed for *Nanhai 1*, was “dangerous and difficult,” says Zhang Wanxing. Engineers slid 36 steel beams, each weighing 5.3 tons, through 15 meters of mud—with an allowance for error of less than 10 centimeters in the murky water. They succeeded, and once *Nanhai 1* was cradled in its container, a floating crane that bobbed precariously on the swells raised it to the surface.

The success put Chinese underwater archaeology on the map—and left Bass, for one, “awed.” “We carried out an excavation that no other country had dared to try,” says Zhang Wanxing. Jeffrey, too, is impressed. “It is something you dream about: sealing the ship and all its cargo and fittings inside a large container, raising it, and bringing it ashore so you can excavate it in sheltered, cleaner, and warmer waters,” he says.

The groundbreaking operation spawned a new concern, however: how long *Nanhai 1* can hold up in its present environment. “Leaving it in water would be highly unusual, as this will eventually degrade the wood,” says INA archaeologist Shelley Wachsmann.



**Nanhai 1 treasures.** Porcelain (left) and a golden belt.

Although *Nanhai 1* is still submerged in seawater, says Zhang Wei, “it’s uncertain how to maintain the chemical and physical environment ... and whether the boat can be protected.”

Simulations done at Sun Yat-sen University in Guangzhou have provided some guidance on ideal conditions for *Nanhai 1*. But “it is not so easy” to put theory into practice, says Zhang Wanxing.

Zhang Wei and others also had nagging doubts about whether *Nanhai 1* survived the move to Hailing, about 75 kilometers from the salvage site. A preliminary analysis organized last summer by Guangdong provincial Institute of Cultural Relics and Archeology was reassuring: *Nanhai 1*, they found, is intact. “That set my mind at rest,” says Zhang Wanxing. The team also excavated portions of the hull and recovered more than 200 artifacts, mostly porcelain. Protecting the ship’s integrity is now the top priority.

Once archaeologists are satisfied *Nanhai 1* can withstand further scrutiny, they will begin a methodical disassembly. The excavation will be carried out in full view in the \$22 million museum, which opened last December. “It’s really a good opportunity for the public to learn about underwater archaeology,” says Zhao Jiabin, director of the Underwater Archaeology Research Center of the National Museum of China. The museum already has loads of artifacts on display and in its storerooms that will help scholars fathom the maritime Silk Road, says Zhang Wanxing. And more secrets are waiting to be revealed. —LI JIAO  
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