concerns over China's sales of missile systems to developing countries and its human rights record. And exports of U.S. satellites for launch on Chinese rockets—a lucrative business for China—have been more tightly controlled since the late 1990s, when a U.S. company was accused of sharing technological secrets with Chinese technicians.

But NASA's new administrator, Sean O'Keefe, said in March that he has discussed the idea of Chinese cooperation on the international space station with Richard Armitage, the deputy secretary of state. Any move would require White House approval, and NASA officials say they don't think anything will happen soon. China has not formally asked to be part of the station effort, but its human space program is widely viewed as a way to prove its technological competence. "It's always seemed to me that China's piloted program is predicated on being a station partner," says John Pike, director of GlobalSecurity.org in Alexandria, Virginia.

Regardless of whether taikonauts ever visit the station, they seem certain to find their way into space. "Peaceful development and mutual benefit should be the basic principle for Sino-American cooperation in space," says Guo. But China is also prepared to go its own way, he says. Either way, the result should be new opportunities for space scientists.

–DENNIS NORMILE, WITH DING YIMIN

Ding Yimin writes for *China Features* in Beijing. Additional reporting by Andrew Lawler.

ARCHAEOLOGY

Report of Oldest Boat Hints at Early Trade Routes

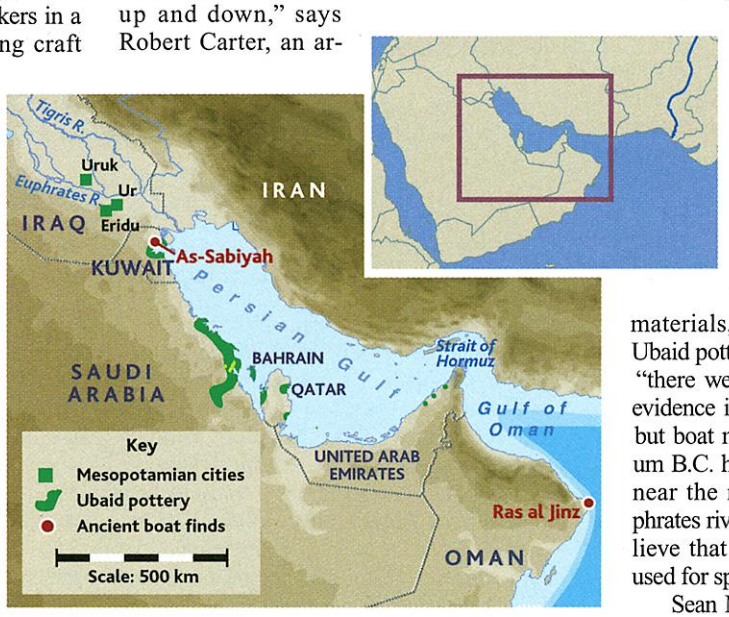
A Kuwaiti site yields 7000-year-old bitumen slabs thought to be from a seafaring vessel; a second team reconstructs a younger ship found in Oman

LONDON—As-Sabiyah, an isolated piece of Kuwaiti desert surrounded by mud flats, seems an unlikely place to store boats, much less sail them. But a team of British and Kuwaiti archaeologists working there believes that more than 7000 years ago, when the Persian Gulf lapped nearby, workers in a small village took apart a seagoing craft made of reeds and tar, its underside still coated with barnacles, and stored it carefully in a stone building. Last year they uncovered those undisturbed remains, which they say represent the world's oldest known boat.

If their interpretation of the material is correct, the discovery pushes back physical evidence of boats by more than 2000 years and sheds light on what later became trading routes linking two ancient civilizations: those of the Indus River valley and Mesopotamia. In particular, it offers concrete evidence to explain how pottery made in the first cities of ancient Mesopotamia ended up at sites hundreds of kilometers to the south on the Persian Gulf's western shores.

Next month Italian and French archaeologists hope to add another piece to the emerging picture of how sailing developed when they finish a controversial reconstruction of a similar vessel, found in Oman and dating from 2400 B.C. They intend to build another version in Oman next year and sail it to Pakistan and India. But the puzzle is complex, warns Harvard University archaeologist Carl Lamberg-Karlovsky. The Omani boat provides little data on how ancient mariners mastered the Indian Ocean, he says, and the Kuwaiti boat was built before true sea-trading networks emerged.

The highlight of the As-Sabiyah find consists of 22 slabs of bitumen, a tarry substance used for a variety of purposes in that region. "I got quite excited and started jumping up and down," says Robert Carter, an archaeologist at University College London and field director for the expedition. "The barnacles on the bitumen give us confidence it's a seagoing craft." Rope, string, and reed-bundle impressions left on the bitumen are thought to be materials used to build the boat.



Gulf stream. Boat evidence from Kuwait and Oman suggests how ancient pottery and, later, trade spread throughout the region and to the Indus River valley.

The age of the site is not in dispute. It was abandoned after the Ubaid period, and calibrated carbon-14 tests put the date at 5511 B.C. to 5324 B.C. Archaeologists working along the Euphrates River in Syria have found similar bitumen slabs dating to 3800 B.C., along with impressions of long-decayed reed bundles, but the slabs lack the barnacles unique to boats used in seas and oceans.

Preliminary analyses show surprisingly advanced planning in the gathering of the materials needed to build the Kuwaiti boat. The bitumen came from a site nearly 100 kilometers distant. And the tarry substance is not pure but mixed with a variety of ingredients—such as fish oil and crushed coral—that match those used in the Oman bitumen 3000 years later. "It's a very sophisticated mixture," says Serge Cleuziou, an archaeologist at the University of Nanterre who has closely studied the Omani amalgam.

Few researchers have looked closely at the As-Sabiyah finds, now at the National Museum in Kuwait City. Joan Oates, an archaeologist at Cambridge University, U.K., who has not seen the materials, says that the prevalence of Ubaid pottery at shore sites makes it clear "there were boats at this time." Textual evidence is absent in this prehistoric era, but boat models from the fifth millennium B.C. have been found at Eridu, a site near the mouth of the Tigris and Euphrates rivers. Even so, some scholars believe that they might have been bowls used for spinning.

Sean McGrail, a maritime archaeologist at Southampton University, U.K., who has seen pictures of the Kuwaiti material, notes that the bitumen "is very fragmentary" and that "it's not necessarily a boat." Then he adds, "but if it is, it will be the earliest around." The earliest undisputed boat is from an Egyptian tomb dated around 3000 B.C., although log canoes built around 8000 B.C.—considered to be more rafts than boats—have been found in the Netherlands and France.

Aside from pushing back the start of modern boatmaking, the Kuwaiti find would help explain how Mesopotamian pottery reached so far south at such an early date.

MAPS: A. STONEBRAKER

The painted shards date from the Ubaid period—6000 B.C. to 3800 B.C.—that immediately preceded the urban explosion at Sumerian sites such as Ur and Eridu. Researchers have assumed that the pottery came via seagoing craft owned by early Mesopotamian merchants eager to exploit marine resources.

Carter speculates that As-Sabiyah was a peninsula in ancient times and an obvious first port of call for boats from the Tigris-Euphrates river system. The site likely began as a campsite and grew into a small village of stone houses whose residents might have built or repaired boats. Stone tools, coupled with the Ubaid pottery and Mesopotamian-made jewelry, hint at a mixed population of Mesopotamians and Arab Neolithic peoples, says Carter. The Arab peoples might have been nomads—similar to the Bedouin in the region today—whereas the Mesopotamians were farmers and town dwellers.

Old times. An archaeologist helps reconstruct a 4500-year-old boat found in Oman. Bitumen remains (*inset*) from older Kuwaiti boat show rope impressions.

Oates maintains that Mesopotamian visitors to the Gulf region traded pottery for fish and perhaps pearls on their way south as far as Qatar and Bahrain. By the middle of the third millennium B.C., their ancestors were exchanging copper from Oman and goods from the distant Indus River valley.

The Omani find offers clues about the transport of goods back and forth across the Arabian Sea, trade that began some 3000 years after the Kuwaiti boat was built. The work, by a French-Italian team, is based on hundreds of pieces of bitumen slabs uncovered from 1985 to 1994. Led by University of Bologna archaeologist Maurizio Tosi, the team is also putting the finishing touches on a 14-meter-long vessel built of bitumen and reeds that could carry nearly 8 tons of cargo. Tosi says the boat will be ready next month, but it won't be tested in water.

The reconstruction venture earns the ire of scholars such as McGrail. McGrail says that there is not nearly enough evidence to justify such an effort. He notes that a recent reconstruction of a Viking vessel required 75% to 80% of its remains and decades of research before a realistic replica could be made. He scoffs at the Omani attempt, noting that it is not even certain the remains are from a boat. "It's crazy," he says. "It's almost wishful thinking." The boat remains provide little data on the mast, keel, rudder, and sails, adds Lamberg-Karlovsky, and the site shows no evidence of warehousing or other obvious signs of international trade. "It's a teaser," he says.

Cleuziou, who hopes to collect enough funding for a second boat to be built next year in Oman that would sail across the Arabian Sea to an area near the mouth of the Indus River in Pakistan, acknowledges that critics such as McGrail "are right to some extent." But he says that ethnographic and textual material is available to supplement the sparse archaeological evidence. For example, Sumerian writings refer to ships capable of hauling 18 tons of cargo to and from Oman. And other texts from around 2100 B.C. list specific amounts of reed bundles, rope, mats, fish oil, and bitumen to build Oman-bound ships. "Of course, this is not a proper reconstructed boat," he says, "since there are many hypotheticals."

In the absence of textual evidence for sails, for instance, the team has chosen to use reed mats instead of wool or cloth. It's also not known what types of bitumen the Sumerians used for boatbuilding. To fill the gaps, Franco D'Agostino, an archaeologist at the University of Rome, earlier this year visited a small village near Basra in southern Iraq, where bitumen is still used in boatbuilding. These methods—dying out with the draining of the marshes by the Iraqi government—have not been extensively studied.

Carter says he is also interested in trying to recreate the boat found by the British and Kuwaiti team, and he hopes to do further work next spring at As-Sabiyah. In the meantime, researchers are grateful for what appears to be the first solid evidence that boats plied the Persian Gulf as the great cities of Mesopotamia took shape, setting the stage for an international trading network. "It's damn good to have the archaeological data," says Lamberg-Karlovsky.

–ANDREW LAWLER

EVOLUTION AND DEVELOPMENT

Comparative Biology Joins The Molecular Age

Researchers are reaching ever farther down the tree of life to probe basic questions of developmental and evolutionary biology

"Too narrow," griped many biologists when in the late 1980s advocates of the Human Genome Project decided to focus sequencing efforts on just a few species. No doubt the sequences of the targeted "model" organisms—the nematode, fruit fly, mouse, human, and, later, zebrafish—would help uncover the genetic underpinnings of human disease, these researchers argued, but limiting research to this slice of the animal kingdom would leave many, more fundamental questions unanswered.

Those genome sequences couldn't explain many mysteries of development: why flies are different from sea urchins, for example, or eagles nothing like sturgeons. They would also provide few clues about evolution or the complement of genes necessary for each class of organisms. To answer such questions, "we need to sample many [places] on the tree of life," says Nipam Patel, an evo-devo researcher at the University of Chicago. Now, researchers are beginning to do just that.

Workers in dozens of labs around the world are sending new species into the sequencing pipeline. And these are not just the next six candidates—the chicken, chimp, honey bee, sea urchin, *Tetrahymena*, and fungi—the National Human Genome Research Institute (NHGRI) selected 2 weeks ago (*Science*, 31 May, p. 1589) but also species as diverse as squid, sea squirts, bats, and stickleback fish. "People are accepting the challenge of going out and [working] on organisms that are not the standard models," says Patel. As a result, the century-old science of comparative biology is making a comeback, this time with a molecular spin.

This trend was evident last month at an evo-devo meeting.* Some two dozen talks dealt with the fruit fly *Drosophila*, but dozens more tapped everything from jellyfish and the flatworm planaria to coelacanths, a living fossil fish. For researchers studying the genome sequences of humans and the original model organisms, finding

* "Evolution of Developmental Diversity," held from 17 to 22 April at Cold Spring Harbor Laboratory, New York.

CREDITS: (TOP TO BOTTOM) THE MAGAN BOAT RECONSTRUCTION PROJECT; R. CARTER/INSTITUTE OF ARCHAEOLOGY, LONDON