Ancient Mesopotamians made rock from silt

Inhabitants of ancient Mesopotamia cultivated crops in the rich soil of the Fertile Crescent. They also took that soil and, thanks to a surprising technological innovation, transformed it into the slabs of rock that they desperately needed for grinding grain and constructing buildings, according to a new study.

Pieces of gray-black rock previously excavated at the second-millennium–B.C. Mesopotamian city of Mashkan-shapir, located in Iraq, look like natural basalt but were actually manufactured by melting and slowly cooling silt, reports a team led by anthropologist Elizabeth C. Stone of the State University of New York at Stony Brook.

"We were surprised to find this level of technological achievement in ancient Mesopotamia," Stone says. "Potters and metalsmiths probably pooled their knowledge to develop an experimental process for making synthetic basalt that eventually yielded a consistent product."

She and her coworkers first noticed signs of intentional manufacture on several large, basalt blocks that had been found near temple remains at Mashkan-shapir. The slabs were all flat on the bottom and bumpy on top.

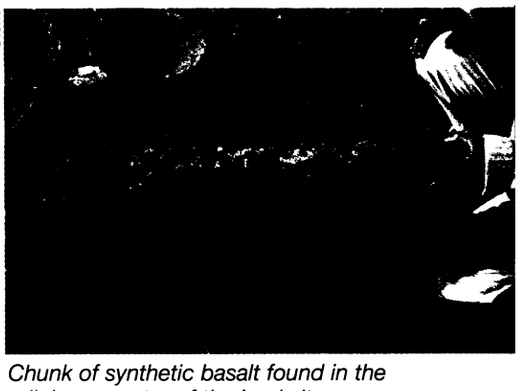
Several hundred rock fragments from around the site displayed the same smooth bottom and uneven top surfaces. The chemical composition of this material is unlike known basalts but resembles that of riverborne silt in the region, the scientists report in the June 26 SCIENCE.

Both synthetic basalt and silt samples from the Mashkan-shapir area melt at temperatures close to 1,200°C, according to experiments conducted by Stone's group using a covered furnace. When the silt was melted, then slowly cooled at a rate of 1°C per minute, the process yielded a hard material like that in the ancient slabs.

Only further excavation at the Iranian site, which has been off-limits to archaeologists since the Gulf War in 1990, will determine how ancient Mesopotamians made synthetic basalt, Stone says. For now, she suspects that charcoal and lumps of silt were melted in large furnaces and left to cool for 20 to 40 hours, the time needed for the crystal growth observed in the blocks.

Many researchers hold that Mesopotamian metalworkers did no more than refine and cast imported pieces of copper and bronze. But evidence of at least small-scale copper production exists at Mashkan-shapir and a nearby site from the same time period, Stone maintains. Ceramic and metallurgical workers may have provided innovations, such as large, high-temperature furnaces, for synthetic basalt production, she theorizes.

Stone



Chunk of synthetic basalt found in the religious quarter of the Iraqi site Mashkan-shapir.

It remains unclear why synthetic basalt production emerged in the second millennium B.C., comments anthropologist Guillermo Algaze of the University of California, San Diego. The mixing of ceramic and metallurgical techniques suggests "a measure of desperation" in the need for basalt, he says.

Rock has long been scarce in southern Mesopotamia, says David J. Killick, a historian of technology at the University of Arizona in Tucson. It's not surprising that inhabitants of Southern Mesopotamia modified different lines of technology to cook up a basalt substitute, an advance that proved "elegant and exciting," Killick remarks. *—B. Bower*

Ultrasound prevents blood loss in surgery

Surgeons have always had a hard time treating wounds or excising tumors in the liver. Designed to filter blood, the organ's spongy, fragile tissue is difficult to close with sutures, so doctors have trouble controlling the bleeding.

Now researchers at the University of Washington in Seattle report success using preoperative ultrasound to prevent internal bleeding in laboratory animals during surgery. They presented their results at this week's joint meeting in Seattle of the Acoustical Society of America and the International Congress on Acoustics. They plan to apply their findings to human patients within a few years.

Over the years, researchers have tested various techniques to stop bleeding in the liver, including cauterization by electric heaters and lasers, says physicist Lawrence Crum of the University of Washington. These methods generally can control bleeding only at the surface of the organ.

Ultrasound, which routinely provides images of internal organs, is being tailored for new uses by researchers (SN: 8/12/95, p. 100). Groups are both administering pretreatment ultrasound and looking for methods to be used during surgery.

Scientists can focus ultrasound inside an organ, heating only the hemorrhaging blood vessels until clots form that close them off. The method could also prove useful in other blood-rich organs such as the spleen and, ultimately, the brain, say the researchers.

"We don't know how well it will work in humans. . . . So far, the results [in laboratory animals] are good," says Kullervo Hynynen of Brigham and Women's Hospital in Boston. He has used ultrasound to seal bleeding arteries in laboratory animals.

Washington bioengineer Roy Martin reports that his team used ultrasound treatments of 4 minutes or less to heat the livers of four rabbits and six pigs, creating regions of tissue walled off to blood flow. The team then surgically removed tissue from those regions.

This pretreatment prevented bleeding in the remaining liver tissue from vessels smaller than 3 millimeters in diameter, Martin reported. The group had less success avoiding blood loss from larger vessels, but those are more amenable to suturing. The researchers plan to track the health and life span of treated animals.

The team employed ultrasound of the same wavelength as is used for diagnostic purposes, but with 20,000 times the intensity, Martin says. At the point of action, the ultrasound reached 2,000 watts per square centimeter.

Success with the method could reduce hospitals' dependence on scarce blood supplies and also shorten operations, Martin notes. It could provide options for patients concerned about contaminated blood or others who oppose transfusions on religious grounds.

The Defense Advanced Research Projects Agency contributed $10 million to the University of Washington research. The defense agency hopes that medics might someday use portable ultrasound devices to stop internal bleeding in wounded soldiers before they reach a hospital, Crum says. Untreated, internal bleeding can lead to death within minutes.

Researchers need to learn how to use ultrasound imaging to more precisely locate internal bleeding from wounds, Martin adds. The University of Washington scientists hope ultimately to develop a portable ultrasound device—something like the exotic medical devices on *Star Trek*—that medics could hold outside the patient's skin to both find and treat wounds. *—J. Brainard*