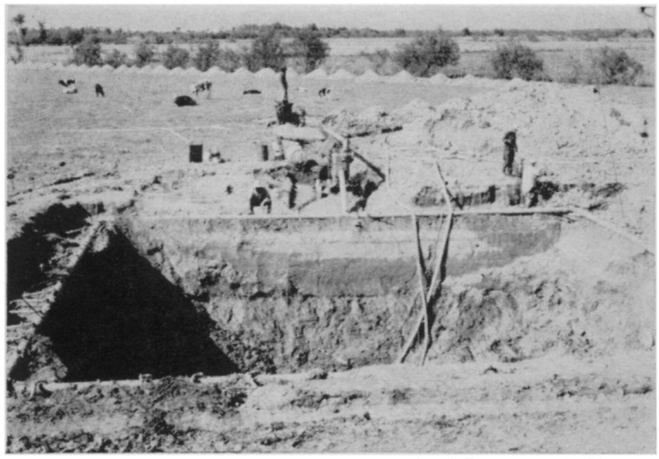
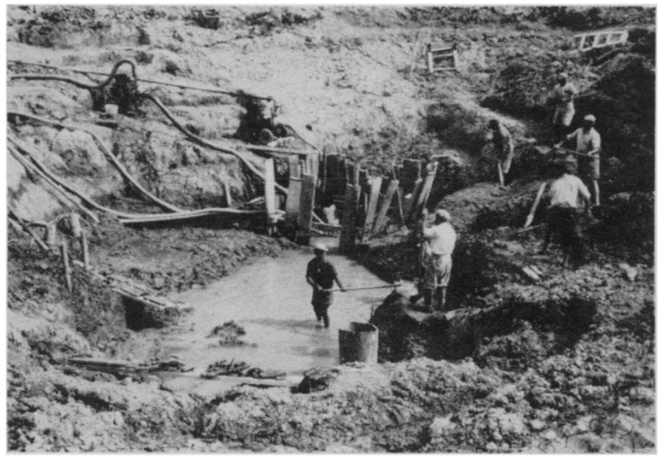


University of Pennsylvania Museum

Excavators drain the soil covering a Sybarite ruin . . .



but mud and water best them, halting the digging.

Sybaris, a muddy prize

Archaeologists find the opulent Greek city but cannot dig it out

Sybaris lies buried in Italian boot.

When thrice three hundred revolving years have run their course, Civil strife upon Rome destruction shall bring and the folly, too, of Sybaris.

—a Roman oracle

Sybaris is one of the great cities of classical literature—opulent, decadent, the prize of Greece's Italian colonies for 200 years. A wealthy Sybarite, it is said, could get a stitch in his side just watching others work. Most thought that drinking bouts contributed greatly to health and they held frequent banquets, notifying women guests a year in advance to give them time for preparations. Sybarites also trained their horses to dance at the celebrations, a conceit which, according to Aristotle, caused their later defeat in war. The city is noted for inventing chamber pots and vapor baths.

Rather suddenly in the late 6th century B.C., Sybaris came to ruin and disappeared. Aristotle says a curse fell on the city through political strife. Other ancient writers attribute its fall to the excesses of the people or to divine displeasure. In any case, in 510 B.C. Sybarites lost a war with the people of neighboring Croton, who sacked and destroyed the city. Then, at some unknown date, the plain on which Sybaris stood, between two rivers, sank below sea level and was apparently covered by a lagoon.

Lost for 2,500 years and the object of a century of searching, Sybaris has now been found by Italian and American archaeologists. What is left of the city lies beneath five meters of sodden clay and water, about two kilometers from the Ionian Sea in southern Italy.

Scientists from the University of Pennsylvania Museum and the Italian Department of Antiquities located Sybaris with a cesium magnetometer, a new instrument about 100 times as sensitive as the sensor commonly used for detecting buried archaeological remains, the proton magnetometer. Both act by measuring levels of magnetism given off by fired objects, such as tiles. Test drills then confirmed the existence of ancient structures dating from the 6th century B.C.

Excavating any portion of the site will be enormously difficult. Seepage, from silt-clogged rivers, and numerous artesian springs help maintain a high water table. Museum excavators tried seven cuts this year, laboriously pumping out water. Each time they reached city level, only to have mud and water gush into the hole. Tiles and building blocks floated through the mess. "You could see the tops of foundations with water flowing over them," says Dr. Froelich G. Rainey, director of the museum. "It was a ghastly business, the worst excavation I've ever seen."

The museum does not plan further attempts at excavation. In Dr. Rainey's opinion, it cannot be done with any equipment known today.

Nevertheless, Italian workers, headed by Prof. Guiseppe Foti, Superintendent of Antiquities of Calabria, will attempt excavation on a major building next spring. It is politically necessary for the Italian archaeologists to produce a verified Sybarite building, thereby identifying the site and its historical worth beyond question, because the area is slated for industrial development.

Sybaris was founded in 720 B.C. by people from the Achaean region of Peloponnesus. Greece at the time was emerging from the dark ages following the fall of the civilization at Mycenae, and embarked on exploration. Greeks colonized first to the east, then went west and established a number of cities in southern Italy and Sicily. Situated between two rivers, then navigable, Sybaris held a favorable trade location for goods flowing between Etruscans, Italian natives in the interior, and other

Greek cities. At its height, the city must have covered an area of several square kilometers. According to various ancient sources the city had a population of 100,000 or even 300,000 people. That was bigger than Athens, which reached its zenith under Pericles half a century after the destruction of Sybaris.

Now, however, only about 20 structures can be located, all of them in an area only a quarter of a kilometer square. The rest of the buildings were probably destroyed by water, if not Crotoniates.

Archaeologists are excited by one building 98 feet long and another possible structure 300 feet long. The latter could conceivably be the ruins of a temple like those at Paestum on Italy's west coast. Paestum was settled by Sybarites and its three temples "are among the greatest Greek temples in existence," says Orville H. Bullitt, a Philadelphia banker and archaeological scholar who supplied a major part of the expedition's backing.

"There may be columns and statues lying around," says Bullitt. "Sybaris was the greatest Greek city of the 6th century B.C. It is possible that some of its riches are still there." Dr. Rainey notes that huge, handsome terra cotta facades on public buildings can be expected from this period.

Some 80 ancient authors have written of Sybaris, usually as an example to be avoided. If the old moralists can be believed, Sybarites became slaves to their bellies and lovers of luxury.

"It would have been lovely to have been a rich Sybarite," says Bullitt. "They did absolutely nothing. They were utterly decadent and produced no great men at all."

Sybaris entered decline when, following civil strife, a group of Sybarites fled to Croton, where the Greek philosopher Pythagorus had considerable influence. Sybaris demanded that Croton give up the exiles, but that city, supposedly persuaded by Pythagorus, refused. War followed.

According to the dancing horse tale, the Crotoniates won the battle by striking up a dance tune for the Sybarite horses. The steeds danced away from the field of battle, taking their riders with them.

On the subject of the sinking of Sybaris, the ancients are strangely silent. Only one mentions its submergence, explaining that Crotoniates diverted a river over the city. Museum authorities, however, believe this would have been impossible and that an earthquake caused Sybaris to sink below sea level. "I don't think any city is buried as deeply as this," says Dr. Rainey. That the ancient writers fail to mention this "is the strangest thing of all."

QUIET DEATH

Protecting the uranium miner

Death enters a uranium mine quietly, through the walls. It moves through the rock in the form of radon gas. Unperceived, it visits the work crew each day until, after a number of years, one miner in 50 learns that he has fatal lung cancer. From 1950 to 1967, lung cancer killed 62 miners of a sample of 3,000: a fifth of the nation's total. That was six times the number expected, even in this high risk group, and far beyond the proportions in the general population.

Concern over the problem has been rising ever since, and on Jan. 1, unless President Johnson intervenes, a new minimum limit for radiation in mines with contracts from the Atomic Energy Commission automatically goes into effect. These AEC-contract mines amount to 75 percent of the total and hire an even larger proportion of the miners. Those miners in other digs, however, remain unprotected, except for state requirements.

The question before the President is one of degrees of safety; should he decide that the limit of three-tenths of a working level recommended to him by the Department of Labor is unnecessarily restrictive, he has the power to adopt a less stringent limit.

His decision will be based—at least in part—on a confidential report prepared by the Federal Radiation Council. Dr. Paul Tompkins, executive director of the FRC, set up to advise the President on radiation matters and composed of cabinet members and the AEC chairman, favors the present limit of one working level, which his organization originally recommended in June 1967, based on U.S. Public Health Service findings. He regards it as a more practical limit. "I chose the Public Health Service standard because it was reachable," Dr. Tompkins says. "I don't think the three-tenths is. One working level standard represented a reasonable risk and should not be unduly restrictive on the mining industry." In 1966, the last year for which there are figures, exposures averaged 2.1 working levels—with only the best mines reaching that figure or below.

The three-tenths level came about last year, when Secretary of Labor W. Willard Wirtz, impressed by reports of lung cancer among uranium miners, set a temporary limit of one working level to be automatically superseded by a three-tenths level on Jan. 1, 1969. Since then the Department of Labor has been battling the AEC and uranium mining companies to determine the safe limits for uranium mines.

One working level is equivalent to one ten-millionth of a microcurie of radon per cubic centimeter of air. A microcurie is one millionth of a curie, which is the equivalent of 37 billion disintegrations a second. Although these are relatively low levels of radiation, no one can agree on what are absolutely safe levels.

Dr. Robley D. Evans, professor of physics at the Massachusetts Institute of Technology, says the current one working level is safe; in fact, he maintains that anywhere from one to three is safe. Based on 35 years of research on radiation damage to humans, Dr. Evans concludes that there is a practical threshold below which the body can repair itself.

From five separate kinds of measurements of human responses to alpha radiation, he concludes that this threshold is not violated at the one working level and that the response at that level is negligible. Dr. Evans also states that one working level is not technologically attainable in all parts of every mine, let alone three-tenths.

Roy Stott, supervising mining engineer for the U.S. Bureau of Mines, sides with Dr. Evans on the unattainability of the three-tenths level. "I am confident that we can get to one working level, but I have a very great question in my mind about three-tenths."

On the other hand, Dr. Karl Z. Morgan of the health physics division of the Oak Ridge National Laboratory says, "The existence of a threshold dose below which the incidence of radiation-induced cancer is zero has not been proven." He cites a report to the Health Physics Society last June which found that miners subjected to one working level for 10 years showed an abnormally high incidence of lung cancer. Dr. Morgan feels that three-tenths of a working level is technologically feasible.

Dr. Walter Snyder, assistant director of the Oak Ridge health physics division, also feels that three-tenths is possible. He adds that there could still be a question though as to whether radon decay products or radon products in combination with other factors such as smoking, dust or dampness cause biological damage. The influence of other factors must be taken into account in setting a safe limit, he says.

Actually it is the products of radon decay rather than the radon itself that cause the damage. These radon daughters, as they are called, are isotopes of polonium, lead and bismuth. Of this group, polonium 214 and 218 are the principal culprits.

The main method of protection now