

[1963]

THE APPLIED SCIENCE CENTER FOR ARCHAEOLOGY
ASCA- University Museum, Philadelphia

The successful application of radiocarbon dating has convinced most of us of the significance of new scientific techniques in archaeology. It opens the way for the acceptance of other techniques growing out of the unprecedented developments in the fields of nuclear physics, electronics, chemistry and the engineering sciences. But there is one fundamental difficulty. Techniques developed for industrial, commercial, or military purposes, as a rule, can be adapted to archaeological purposes only with extensive experimentation and considerable cost. Moreover, thousands of research laboratories of all kinds are now making available innumerable technological advances which might be applicable. It is necessary to discover what they are, and to select the most promising for experiment.

ASCA, which was established at the University Museum in Philadelphia about three years ago with a grant from the National Science Foundation, attempts to co-ordinate information about such techniques and to experiment with and develop certain of them which, at the moment, appear to be most readily applicable. Its model is the Research Laboratory for Archaeology and the History of Art at Oxford, but it hopes to tap the resources in the United States more directly and at the same time to keep in touch with Oxford so that it does not duplicate any particular kind of research.

In the nature of things these days, any research in physics, chemistry, or electronic techniques is bound to be expensive, at least in terms of what

archaeologists normally expend, and thus ASCA cannot expect to finance any very original or fundamental inventions in an archaeological laboratory. What it hopes to do is to discover techniques developed by industries and commercial laboratories that are applicable to archaeology and to make the necessary adaptations through experimentation.

Even this requires financial and technical aid from the industrial firms. In fact, the National Science Foundation grant makes possible the maintenance of a small technical staff, an information center, a laboratory with limited equipment, and primarily, field and laboratory testing. In the development of new instruments, substantial financial and professional assistance is obtained from companies, individuals and other foundations which would not be possible without the nucleus supported by the NSF.

An information center with a card file of reference to "Scientific Aids for Archaeology" is now established to include reports of analyses (chemical and otherwise) of ancient objects, lists of laboratories where various facilities are available, results and methods of dating techniques, field survey reports and methods, and other new techniques which may apply to archaeology. The Center is also collecting books and publications in this field. It is, of course, open to all archaeologists and will supply any reasonable information upon request. However, it is in its early stages and is by no means a complete file on what is now taking place.

Experiment with, and development of electronic instruments for underground exploration is at present one of the primary tasks of ASCA. As a

beginning, work is proceeding on different types of instruments: resistivity, seismic, magnetic, sonic, and metal detectors. Two of these types (resistivity and magnetic) are well-proven instruments developed in England, Germany and Italy.

The Gossen Company, in Germany makes a light-weight, inexpensive and sturdy resistivity instrument which ASCA has tested extensively at Tarquinia and Sybaris, in Italy, with very satisfactory results. Three of the instruments are now in the laboratory and can be loaned to other institutions or archaeological expeditions wishing to utilize them.

The Littlemore Scientific Engineering Company, Oxford, England, makes an excellent proton-magnetometer, which was also tested at length in Italy with notable success at Sybaris where archaeological "anomalies" were detected to a depth of as much as 5 meters. Since it is an expensive (\$2-3000) and relatively delicate instrument, the laboratory owns only one which it can lend under rather special circumstances. A second and related magnetic instrument called a "gradiometer" has been constructed here in Philadelphia for the laboratory, and will soon be tested in the field.

A seismic instrument manufactured by Geophysical Specialties Company, Hopkins, Minnesota, has also been tested in the Southwest U. S. and in Italy. It may be possible to detect archaeological features with such an instrument, but for various reasons ASCA has concluded that this type is not promising for archaeology.

A new sonic device has now been constructed by Grey MacLaughlin, for

the laboratory during the past year. The first of its kind, it is still in a highly experimental stage. Basic research required to perfect such an instrument is now being undertaken for the laboratory by the Petty Geophysical Co. in San Antonio and also through collaboration with the Texas Instruments Co. in Dallas. In essence, a high frequency pulsed wave is sent into the ground and reflected from underground (archaeological) features so that they can be detected on a cathode ray screen. If successful, this will be a much more versatile instrument for archaeological surveying than the resistance or magnetic types.

Finally, the laboratory is also working on a transistorized metal detector. It is designed to have greater sensitivity than the military devices presently available.

Related to the electronic instruments are the various types of power-driven drills which are used to test anomalies detected with the instruments. At Sybaris drills have been most useful in probing archaeological anomalies and in recovering potsherd samples in stratified deposits up to 8 meters in depth.

Elizabeth Ralph, Associate Director of ASCA, who has been working on refinements in the radiocarbon dating method for some years, is now also working with the thermoluminescence method of dating pottery, assisted by Mark Han, also of the laboratory. Progress is being made with the alpha counting phase of the project, and with the detection of very weak glow curves.

Henry Michael is conducting a dendrochronology project which is connected

with refinements in the radiocarbon method (fluctuations in the atmospheric C-14 inventory in past times) but which may also result in more accurate dating for Egyptian archaeology. A sensitive tree growth record worked out with the logs from the great tomb at Gordion, in Turkey, suggests that it is possible to apply dendrochronology in Egypt.

Various applications of chemical, metallurgical, and physical techniques for analysis and identification are being explored by A. E. Parkinson and Mark Han. For example the "spectronal" is being used for trace analyses of metals (bronze objects from Iran and the bronze age wrecks off Turkey), the electron microscope is being used to determine whether it is possible to detect fake gold objects, the ultrasonic decontaminater has been used for cleaning bronzes, pottery, and other delicate objects; experiments are being made with a polarograph and the emission spectrograph, and the intention is to establish soon a more ambitious project in the study of the origin and development of metals, ¹ in collaboration with Professor Cyril Smith of M. I. T. and Professor Robert Maddin of the University of Pennsylvania,

Instruction in most of these scientific techniques for graduate students in archaeology is available in the general techniques course being taught here by Bernard Wailes.

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other centers such as those in England and Italy. Moreover, direct working relations have been established with the Lerici Foundation in Rome, the Tree-Ring Laboratory in Tucson, the Research Laboratory for Archaeology and the History of Art at Oxford, and the physics, chemistry and metallurgy departments in the University of Pennsylvania, the Sun Oil Company Laboratories, the Texas Instruments Company, the Petty Geophysical Company, and the Technical Laboratory of the Museum in Cairo. It is important to avoid duplications, since technical applications are expanding so rapidly, and to collaborate as much as possible to prove or disprove specific new instruments and techniques as quickly as possible. ASCA is anxious to exchange information and to assist archaeologists from other institutions when that will expedite the development or conformation of any of these applications. The staff welcomes enquiries and suggestions.

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