[REPORT ?]

ARCHAEOLOGICAL SURVEYS IN ITALY WITH NEW TECHNICAL TOOLS

During the last quarter 1961, a very important campaign of archaeological survey has been carried out in Italy. The extraordinary importance is due to the fact that, for the first time, new scientific equipments for research have been used and, moreover, a co-operation between the University (Museum) of Pennsylvania and the Milan Engineering School has been tried in both technical and organizational field.

The results obtained -briefly summarized herein- have passed the most optimistic previsions, because, while on the one hand they have confirmed the steady progress in the survey technical equipment, on the other they evidenced the extraordinary efficiency of an international co-operation such as that between the two institutions of Philadelphia and Milan.

New Technical Tools

The team of the Milan Engineering School participated in the campaign with its survey equipment, comprising two types of potentiometer with electronic voltmeter, one electric boring drill, the photographic drill and the periscope for the exploration of chamber tombs. All these instruments were designed by the Laboratory of the Lerici Foundation in the Milan Engineering School.

The Museum of the University of Pennsylvania was present with the proton magnetometer, one portable magnetometer and one resistance equipment boring drill ~~such as that,~~ made by the Houston Tool, for the first seismic equipment spaceship which will reach the moon.

Members of the expedition were: mr. Froelich Rainey, mr. Delmage and mr. Linington for the University of Pennsylvania; mr. Lerici, miss Vanoni and mr. Brancaleoni for the Milan Engineering School.

Campaigns were carried out in various archaeological areas, different for both nature of the soil and purposes of research. These circumstances give far greater value to the results obtained.

Archaeological Area of ~~Sibari~~ SYBARIS (Calabria)

This area is crossed by the last part of the river Crati and consists in a flat plain of alluvial soil, formed by the deposits accumulated, in more than 25 centuries, by the rivers Crati and Coscile over the archaeological layer of the ancient Greek town of Sybaris. The most recent surveys revealed that the deposit is more than 5 meter deep and that there is a desplacement of more than 1 kilometer from the coast towards the Ionio sea. Moreover, the same bed of the river Crati has notably raised -and this is due to the recent works of land reclamation- so that the excavations all over this area are made very difficult by the high level of the underground waters and the consequent need of draining and barrage.

In 1961, the Lerici Foundation had already carried out a short experimental campaign in this region, exploring the area -shown by Fig.1- with her equipments for electrical sounding and a stratigraphic drill. A buried wall feature was identified and it was possible to follow and check it through superficial excavations along 150 meters. Besides this important feature, it was possible to verify the presence of other walls in other places, but it was impossible to establish

their real dimension for the difficulty of making excavations, due to the level of the underground water bed. During the new campaign carried out in September 1961, with the aid of the proton magnetometer, it was possible to find another section of the already discovered wall feature, that now reaches the lenght of 750 mts. Other considerable features have been identified. Fig. 1 shows the development of the principal wall already found and the other identified features. It was impossible to make deep excavations because the presence of water made it very difficult and did not allow the measurement of the real dimensions of such wall. We hope that, during a new campaign, which should be organized in 1962, it will be possible to bring these features to the light of the sun, at least in their essential parts. Fig.2 shows the team at work and Fig...gives a tipical diagram of signals, obtained with the proton magnetometer, which allowed the identification of the lenght of the big wall feature.

Etruscan Cemetery of Tarquinia

In this cemetery -famous for the paintings found- the Lerici Foundation has spotted more than 30 painted tombs from 1956 to 1961, almost exclusively making use of the potentiometric method based on the measurement of the soil resistivity (electrical sounding). As great part of the cemetery has not yet been explored, we had the opportunity of experimenting both the proton magnetometer and the portable seismic equipment and of making advisable comparisons of efficiency with the electrical method.

The soil is marine (shell limestone) and the prevalent tomb features consist of chambers dug into the compact layer of the deposit, at depths varying from 2 to 6 meters under the surface. The entrances are accessible through steep ramps, dug trenchlike and, of course, invisible, because they are completely filled with earth and levelled by the action of winds and superficial plowing. Orizontal electrical soundings carried out by the Lerici Foundation can reveal the electrical resistivity anomalies caused by the cavities of the chamber tombs and by the different behaviour of the filling material in the entrance trenches.

Before making an extensive survey with the proton magnetometer, compared measurements on single features were carried out, making use of the three methods: electrical, seismic and magnetometric.

Fig... shows the anomalies registered with these three methods, which confirm that the proton magnetometer can identify the type of tomb features buried in this area.

Successively the magnetometer was used for the exploration by means of a 50x25 mts. grid: readings were made at intervals of 1 mt., i.e. 1250 readings complexively.

The result of this survey is shown by Figgs..., which show how, also for this type of features and soil, so frequent in all archaeological areas of ancient Etruria, the proton magnetometer can reveal the buried tombs rapidly and exactly.

The time complexively employed for the readings was more or less 15' each 100 readings. Considering the time required by the elabora-

tion of the complete series of isoanomalous lines, by the corrections due to the local magnetic inclination and by other possible causes of static, the saving of time, compared with that necessary for orizontal electrical soundings, was sensible.

Even the number of positive drillings -made in those places where the anomalies were registered- seemed to pass that obtainable with electrical soundings.

Cemetery of Bufolareccia (Cerveteri)

This Etruscan cemetery, unlike that of Tarquinia, lies in a volcanic sedimentary ground (tufa). Here too the tomb features consist mainly in chamber tombs dug in the tufa at a depth varying from 1.5 to 5 meters under the surface and -like those of Tarquinia- have an invisible entrance trench. Considering the volcanic nature of the deposit, the fact that the chambers are smaller than those of the cemetery of Tarquinia and, moreover, that a great number of tombs is filled with earth, water or mud, it was very doubtful whether the proton magnetometer could reveal them. Electrical soundings -that were carried out by the Lerici Foundation and revealed, in the years from 1956 to 1960, about 600 tombs in the area of Cerveteri- showed that it was equally possible to identify, through the resistivity anomalies, also collapsed and flooded tombs.

After some preliminary tentatives with positive results, a total exploration -by means of a proton magnetometer- was carried out over a rectangular area (50 mts. x ....): readings were made at intervals of 1 meter.

Contrary to expectations, the result was markedly positive and it was possible to verify that also in volcanic areas -very frequent in Italian archaeological zones- features of cemeteries are easy to be found with the proton magnetometer.

The results we have briefly summarized afford a document of great scientific interest about the opportunities of the use of a proton magnetometer. It is according to these results that the Lerici Foundation decided to provide her surveying teams with this type of equipment.

Naturally other surveys, extended to other types of archaeological features and soils, will be necessary. The Lerici Foundation intends to devote one of her teams, during 1962, to applications of the proton magnetometer with a view to collect the most various casuistry, which could allow to establish definitely the limits and possibilities of use of this new method.

The Milan Engineering School is very grateful to the University of Pennsylvania for the assistence given, thus allowing the above described experiments, and wishes to have the opportunity, in the future, of developing the activity of research in Italy and abroad, with the co-operation -that proved so efficient- of the experts of the University of Pennsylvania and the Research Laboratory of the University of Oxford.