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Archaeological Field Survey and the Danish Natural Gas Project

by H. C. VORTING

INTRODUCTION

In 1979 it was decided to provide the Danish consumers with natural gas from the North Sea. This meant the commencement of the largest construction project so far in Danish history, and also the largest archaeological rescue operation in the history of Danish archaeology. The excavations had to be carried out within a 30-metre or 20-metre wide strip along the 2,000 kilometres of gas pipeline – 30 m at the transmission lines and 20 m at the distribution lines (fig. 1).

Since its beginning and up to January 1st 1983 the project has been administered by the Agency for the Protection of Nature, Monuments and Sites. After January 1st 1983 by the keeper of National Antiquities.

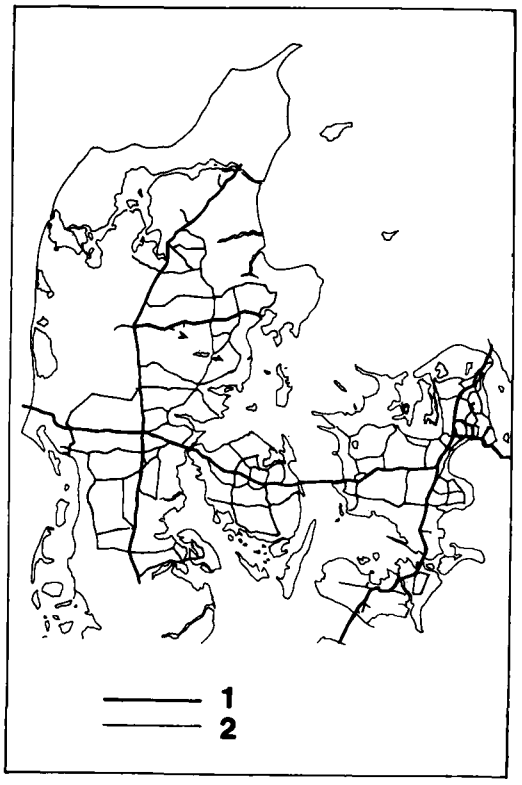

Fig. 1. Map showing the major gas pipelines in Denmark. 1. Transmission lines. – 2. Distribution lines.

A five-stage strategy has been employed:

1) In the planning phase, the administration acts in close collaboration with the natural gas company. All monuments within a 700-metre zone of the planned gas pipeline are mapped in. Today this is done by computer. The company will then alter the planned course of the pipeline to avoid any known monuments.
2) When the line has been marked out in the field, all monuments are inspected and precisely localized. The company will then again adjust the planned course of pipeline to avoid any visible monuments. As a result only very few visible monuments are, or will be affected by the pipeline when it is laid over the full distance of 2,000 km.
3) The third step includes field-surveys along the 30 or 20 m wide construction zone of the pipeline for any indications of ancient settlement. (Barrows have already been avoided, cf. point 2).
4) Small preliminary trial excavations are carried out in order to determine if a full excavation shall be undertaken.
5) Full excavations are undertaken at well preserved sites.

The project opens up fresh perspectives for research. For example, it provides across-section of settlement types, their location, size, etc., through all the major topographical zones of Denmark. It also enables new methods of survey and excavation to be developed and tested, including sampling and air photography. This has been done as the preparations for laying the pipeline progressed, not only to improve techniques but also, when possible, to improve the economical basis for these investigations. Consequently, surveying and trial excavations have so far (in 1982) become 50% cheaper – with no loss of information – than at the com-

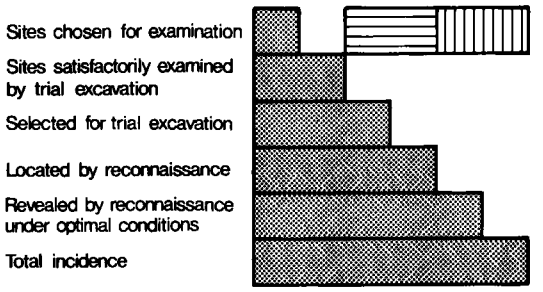

Fig. 2. Table showing how sites worth excavating were missed by the preliminary field-work due to inadequate methods. The proportions are fictive (worked out by J.Aa. Pedersen).

mencement of the project in late 1979. Thus more money can be spent on final excavations. Research reports on this methodological development have been published only in Danish (1).

In this paper, some preliminary analyses of field-surveying methods are to be presented, as it is believed that they apply to most other North European lowland areas (see also the article by Jørgen A. Jørgensen, this volume).

During the first phase of the project in Southern Jutland all sites with settlement indicators were test excavated in order to establish a comparative material which, when analyzed, would allow a more selective approach to test excavations and final excavations: the object being to exclude "negative sites" as early as possible. The folowing analysis was designed mainly to fulfil this goal. We are fully aware that many factors not considered have a significant impact on the results presented – e.g. surveying method, (intensive/extensive) number of surveys, weather and time of the year, experience and personal bias etc. It should also be added that in the first phase field surveying was not supplemented with alternative methods, e.g. sampling. However, certain sections of pipeline were inspected after the machinery had removed the soil and dug the trench, in order to test how good or bad the survey had been. Although it was extremely difficult to make observations because of the disturbance caused by heavy machinery, only very few sites not already recognized during field-walking were observed in the trench. Yet it must be admitted that the field-walking method was less favourable in Zealand due here to heavy soils, and in some areas we were forced to add stratified sampling (based on topographical criteria) as an extra precaution. In the following, we will concentrate upon analyzing the relationship between observed settlement indicators on the ground and their relation to underlying settlement structures. Thus, we leave the question of settlements without settlement indicators out of consideration.

RECONNAISSANCE

To the trained observer, many ancient monuments and remains concealed in the ground will often betray themselves in the cultural landscape through increasing disintegration or some other cause. Therefore, thorough field-work in the form of surface survey is in our opinion the best and most serviceable method of finding new evidence of past human activity, well knowing that some types of ancient remains cannot be found in this manner. The aim of such reconnaissance is to piece together as complete a picture as possible of the location and extent of past activity in a given area. The collected data will then provide the basis for deciding whether further examinations should be made, beginning with a trial excavation.

There is no doubt, however, that the evidence recorded by field-surveys is of scientific and culture-historical value, whether or not further investigations are undertaken. It must be recognized in principle that all prehistoric artefacts over and above a minimal limit are indications of some kind of early activity in a given place, provided there is no evidence to the contrary such as earth filling from elsewhere, gravel quarrying, etc. And, of course, providing that the material has been reliably and professionally collected.

The timing of field-surveys is of great importance, and it is possibly the only serious limitation of the method. Not many observations can be made during the summer months when crops cover the fields, and even after the principal harvest, there still remain fields of beet and maize which make reconnaissance difficult. Winter cereals are increasingly sown in Denmark, and areas with these crops present some difficulty when field surveying during the autumn and winter. Meadows permanently under grass are of course out of the question for field-work of this nature.

However, from November – and in some cases a little earlier – when the amount of uncropped land is greatest (and not freshly ploughed or harrowed), and until

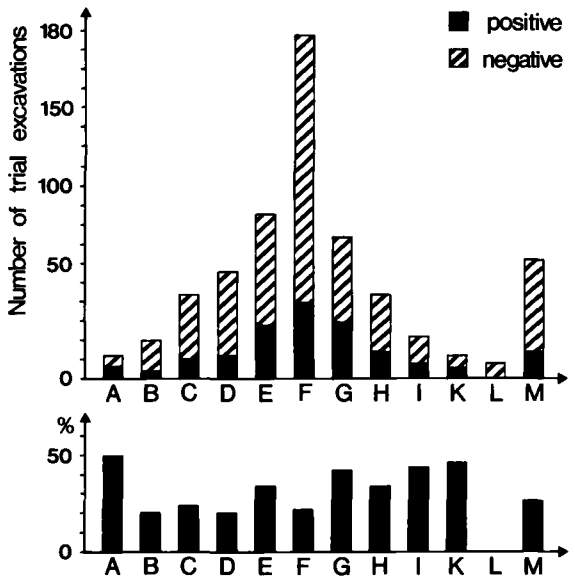

Fig. 3. The composition of stray finds and their distribution on sites worth excavating (positive localities). – Table above: Finds recovered by field-surveys, divided into categories (indicators); their incidence on sites where trial excavations were undertaken. All stretches of pipeline 1979–1980. – Table below: Distribution of the same indicators on positive sites expressed as percentages.

A – Bifacially retouched tool types
B – Axes and axe fragments
C – Blade and flake cores
D – Blades
E – Other flint tools
F – Flint waste
G – Datable prehistoric potsherds
H – Fire shattered stones
I – Slag
K – Hammerstones
L – Other potsherds
M – Burnt flint

March, sometimes slightly later, field reconnaissance yields satisfactory results provided the terrain is not buried under snow. Weather and light conditions obviously affect results.

In spite of these difficulties we have so far managed to undertake the reconnaissance of between two-thirds and three-quarters of the terrain affected by the construction of the natural gas pipeline, and the remainder has largely been grassland. At worst, over short distances, the unsuitable areas constituted up to half, but elsewhere they amounted to less than one-quarter of a given distance.

In B2, the preliminary report (see note 1) dealing with the investigative method, two concepts were launched; namely, the *intensive* and the *extensive* field-survey. It is arguable whether indeed the terms are valid, as "extensive" could imply a less thorough survey than the intensive survey, which is by no means the case. It is in principle a matter of two theoretical extremes. By intensive reconnaissance is meant that the area is evenly reconnoitred at a steady speed, regardless of the terrain and frequency of finds. Whereas extensive reconnaissance means passing lightly over unlikely places, but carrying out a more thorough search in localities where finds would be expected.

If consistently undertaken, intensive reconnaissance ought to be the more objective method because, if all else were excluded, the results from different tracts of land would be directly comparable. Yet a large number of variables will always prevail; for example, tillage conditions, weather, light, and last but not least, the psychological factors which can give the illusion of objectivity. The speed of reconnoitring is obviously influenced by all this and it is difficult to maintain consistency when working according to this method.

On the other hand, the extensive approach is by definition subjective, and it also requires a greater degree of prior knowledge. In any event it is extremely important to exercise great caution when deciding what to leave out or what to walk quickly across if there seems little chance of finding anything. If at all, these are decisions which can only be made by very experienced field-workers. Yet by concentrating less on unpromising areas, time is saved for more exhaustive searches in places where finds would be expected. It also allows a clearer picture to emerge of the character and extent of sites found which, in turn, provide a firmer basis for assessing whether trial excavations should be carried out.

A combination of both methods is generally adopted, although the more inexperienced the field-worker, the more closely he or she ought to follow the guidelines for intensive reconnaissance. It is likewise essential to realize that no criteria will be entirely objective.

The time taken to accomplish a field-survey varies according to weather conditions, the terrain, soil conditions, and particularly the frequency of finds. As already mentined, the last point does not affect the intensive method, as relatively restricted localities will be recorded by this method. But if the extensive method is used a number of the small localities will tend to merge,

giving fewer but larger localities. Regardless of which of the two methods is adopted, the average speed along the construction zone of the pipeline should preferably be about 2 km daily, across a breadth of 20 m – 30 m. Sometimes it can be an advantage to repeat a field-survey, for example if the first has been undertaken in bad conditions, and the opportunity to make a second attempt arises.

PRELIMINARY RESULTS

The next stage after the reconnaissance is to decide where to try an exploratory excavation. What are the criteria? Is there any connection at all between stray surface finds and the probability of finding archaeological traces or remains in the ground? The answer is surely that without some conviction that this is indeed the case one might as well abandon field reconnaissance. Yet the relation between surface finds and archaeological remains in the ground is not entirely straightforward, and a deeper statistical analysis of the collected data will be necessary before the stage can be reached when it will be possible to select sites for trial excavation, and be secure in the knowledge that archaeological remains will be discovered.

In the first place, an analysis of the first 195 trial excavations showed that there are some surface indicators (groups of finds) which signify to a greater extent than others, the likelihood of a positive trial excavation, i.e. leading to further excavations. This is shown, for example, in fig. 3., although it is evident that indicators are not in themselves entirely reliable.

Secondly, it is apparent that the greater the number of indicators, the better is the chance, roughly speaking, of a positive trial excavation (fig. 4).

Thirdly, the analyses demonstrate that it is possible to lay down certain minimum criteria before selecting a site for trial excavation, without a loss of positive sites. These criteria are as follows: a surface showing of at least 2 indicators, one of which being datable prehistoric potsherds or 10–20 flint flakes. Or 3 indicators, one of which being a single or several tool(s).

Experience has shown that a couple of trial excavations started on the basis of 3 indicators could have been omitted, as well as a certain amount on the basis of 2 indicators, and all in places with only 1 indicator. Here it should be stressed, however, that burnt flint is

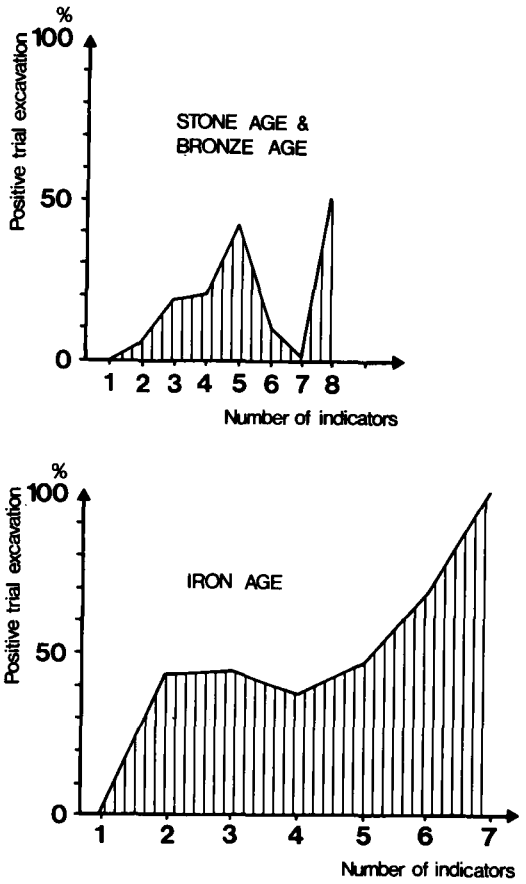

Fig. 4. Ratio between sites worth excavating and number of (datable) types of surface finds collected during reconnaissance (worked out by Peter B. Christensen).

not included as an indicator in fig. 3, because preliminary sample analyses showed that it held no significance in the given context.

Moreover, apart from the group with 10–20 flint flakes, the number of items in each group of indicators has not been taken into account. It will also surprise some people to hear, for example, that in localities where flint flakes have been found the degree of "positivity" does not increase in proportion to the quantity of flint – the reverse is sooner the case, whereas potsherds in large amounts is an almost certain indicator.

In conclusion, a few remarks are called for about the reliability of the present material. It ought not to be accepted all too uncritically. From the start, it has been a question of material, subjectively assessed, full of unknown quantities and difficult to formulate. It is all the more surprising, then, that some statistical analyses (with known and unknown uncertainties and inaccura-

Stretch	Length	Sites localized	Sites pr. km.	Sites chosen for trial excavation	No. of trial excavations	Positive trials	No. of positive trials per km
Frøslev-Egtved	90	ca. 100	1.1	79=79%	68	18=26.5%	0.2
Nybro-Egtved	55	24	0.4	15=62.5%	15	3=30.0%	0.05
Sønderborg-Nordborg	28	95	3.4	43=45.5%	22	5=22.7%	0.26?
Kærgård-Egtved	75	12	0.2	8=66.7%	12	1= 8.3%	0.013
Egtved-Fredericia	45	44	1.0	30=68.0%	30	9=30.0%	0.2
Tønder-Tinglev	25	24	1.0	16=66.7%	14	4=28.6%	0.28
Frøslev-Sønderborg	37	100	2.7	46=46.0%	42	10=23.8%	0.27
Egtved-Ll. Bælt	34	(122)	(3.6)	(60=49.1%) 39	(47) 34	(11=23.4%) (9=26.5%)	0.26
Egtved-Koelbjerg	32	(66)	(2.1)	(33=50.0%) 25	(33) 25	(8=24.2%) (6=24.0%)	0.19

Fig. 5. Schematic table of site frequencies along the construction line. Note the somewhat weak representation in West Jutland.

cies) nonetheless produced some firm results. But for the time being in any event, these should be considered indicative: a reflection of certain tendencies. There must still be room for individual assessment.

Finally, one or two more general observations ought to be briefly mentioned. It is quite interesting to compare the distribution of recorded sites in the National Museum's central register (chiefly barrows) with the localities detected by field-survey (chiefly settlements). Although by and large two different categories of monument, our preliminary analyses suggest a significant link between them. It appears that known monuments serve to some degree as indicators of the intensity of prehistoric settlement in a given area, and this is useful in the preliminary stages of a field-survey, but obviously subject to considerable local variations.

It was also found that while field-surveys seemed to indicate that the proportion of Neolithic, Bronze Age and Iron Age sites was more or less equal, trial excavations reduced the number of Neolithic and Bronze Age settlement sites, and that after the concluding excavations there would be a preponderance of iron Age settlement traces, some from the Bronze Age, and extremely few from the Neolithic. Therefore, in many cases, a site localized through neolithic finds of flint proved, when under final excavation, to be largely of the Iron Age. One explanation is that the same localities were chosen for settlement throughout antiquity. The latest and usually the most extensive form, namely the settlements of the Iron Age have thus helped to obliterate traces of former habitation.

Obviously, the cultivation of the same soil through the millenia is also a substantial cause of the destruction of earlier settlement traces. And it is self-evident that the earliest settlement on arable land is almost always the most fragmentary. Only worked flint on the surface and, in exceptionally fortunate circumstances, a few potsherds, can give us some idea today of the frequency and distribution of Stone (and Bronze) Age settlements in the landscape.

Hans Christian Vorting, *Rigsantikvarens arkæologiske Sekretariat*, Frederiksholms Kanal 12, DK-1220 København K.

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