Flight over the future motorway. Airphotos in Polish rescue archaeology

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Abstract. Air reconnaissance as an indispensable part of a major archaeological rescue project has not gained wide recognition in Poland yet. One of the first opportunities to apply it on a wider scale was the extensive motorway construction project (ca 2500 km of motorways to be built within the next 10-15 years). A pilot project for systematic air photo taking and interpretation in order to locate possibly all endangered sites was executed in Mid-western Poland (Poznań area) in 1999-2000 on a fragment of the planned motorway ca 100 km long. After taking over 1000 air photos during two helicopter flights they were analyzed, rectified and inserted into a GIS module of regional SMR, based on the ***MapInfo*** system. Finally, a description of the applied research procedures was published as a slide presentation on the WWW page ***Archaeology in Poland*** in order to make the method wider known.

In recent years the region of Greater Poland (Mid-Western part of the country) has been flourishing with the investment boom that includes the great undertakings of international scope, ie. a section of the Yamal Peninsula (Siberia) – Western Europe gas pipeline and the A2 motorway section from Frankfurt/Oder through Poznań to Warsaw (Fig. 1; Mazurowski and Zapaśnik 2002).

Fig. 1. The planned Polish motorway network and the route of the Yamal Peninsula (Siberia) – Western Europe gas pipeline (Polish section)

These large-scale construction undertakings created the highest threat to the whole environment and particularly to archaeological heritage. According to the Polish legislation, they should – and have been – preceded by thorough field survey in order to localize and evaluate all existing archaeological sites. The possibly complete list of sites which was compiled during such reconnaissance serves as a basis to formulate a program of further rescue activities, mainly - excavations of all endangered and valuable sites. The rich experience on traditional fieldwalking gathered during the execution of a long-term project of Polish Archaeological Survey (which started in 1975) proves that this method alone does not bring satisfactory results and should be controlled by other methods. One of them could be air reconnaissance which proved to be very efficient in several European countries. (Bewley and Rączkowski 2002, Nowakowski and Rączkowski 2000). What follows is a short case study of an introductory stage of a major archaeological rescue project. As we shall try to prove, already at its first step – the reconnaissance – it could be intensified by using some computer applications and procedures.

Although the tradition of applying air photos for documentary aims in Polish archaeology dates back to the 1920-ies, the method of air reconnaissance as an indispensable part of the early stage of the archaeological rescue project has not gained general recognition yet. One of the first opportunities to apply it on a wider scale was the intensive archaeological survey along a section of the planned motorway in Mid-Western Poland (a part of the all-Polish motorway construction project - ca 2500 km long, to be built within the next 10-15 years; fig. 1).

A pilot project for systematic air photo taking and interpretation in order to locate sites endangered by the planned motorways was executed in Mid-western Poland (Poznań area) in 1999-2000 by the Poznań Archaeological Museum. It covered a fragment of the future motorway ca 100 km long. The project included:

a/ two helicopter flights over a chosen fragment of the motorway,

b/ taking photos of three categories of objects:

- known archaeological sites,
- all traces that might be archaeologically meaningful (ie. cropmarks and soilmarks),
- areas under excavation

c/ analysis of the photos by archaeologist trained as airphoto interpreter,

d/ rectification of the oblique photos,

e/ insertion of the photos with identified archaeological features into a digitized topographic map of ***MapInfo*** system (wherever possible),

f/ publication of the description of the applied research procedures and results in the form of electronic presentation on the WWW page ***Archaeology in Poland*** in order to make the method wider known and used.

The starting point was to prepare a map with all known archaeological sites, situated within the threat zone of the planned motorway (fig. 2).

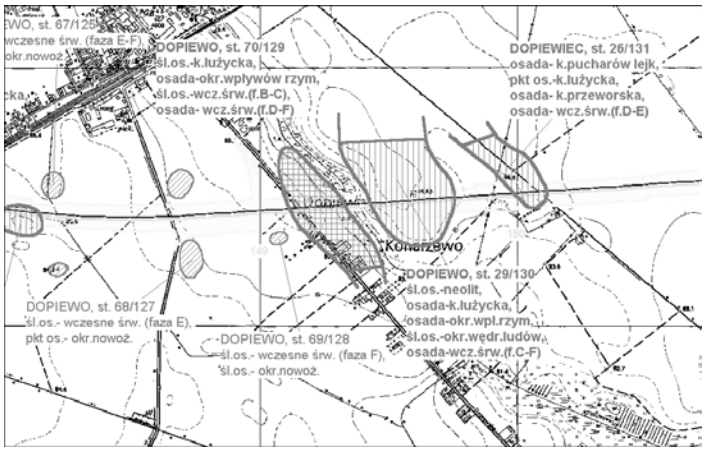

Fig. 2. Fragment of archaeological map of the planned motorway launched by GIS module of regional SMR

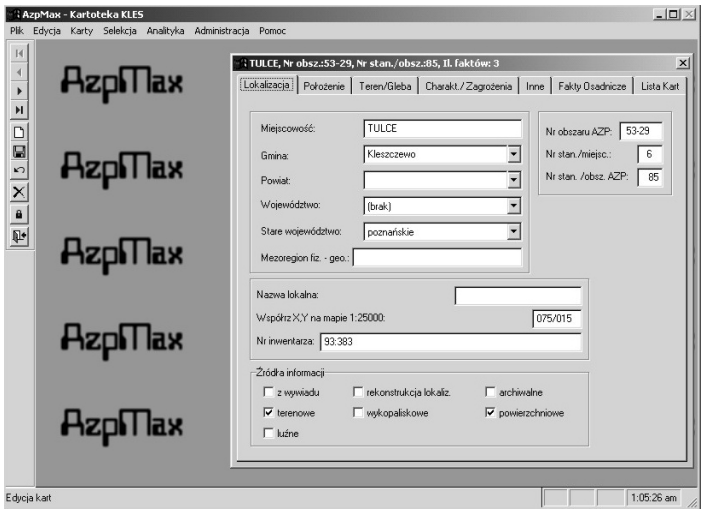

Fig. 3. Regional SMR database for region of Greater Poland (Poznań area); text module

It could be automatized due to the computerized Sites & Monuments Record for the region of Greater Poland, which has been systematically built up since 1986 at the Poznań Archaeological Museum (fig. 3; Prinke 1997a, 1997b). The system includes a simple GIS module based upon ***MapInfo*** GIS system (Prinke 1999).

The flights were executed with the Soviet MI-2 helicopter. Navigation was carried out with GPS and 1:50 000 scale topographic maps. Two persons were taking pictures with the following cameras: Canon EOS 500N and Pentax MZ50 (24x36 format) and Pentacon six TL (6x6 format). Both color and black-and-white photos, as well as color slides (Kodak films) were used. As a result of the flights, over 1000 oblique air photos were taken. Their analysis and interpretation, executed by Dr. Włodzimierz Rączkowski (Institute of Prehistory, Adam Mickiewicz University, Poznań) disclosed probable traces of archaeological relics on over 130 photos. The conclusions are based mainly upon the presence of anomalies in vegetation (cropmarks), disclosing the differences of humidity and structure of the soil. Below is a choice of the results of this interpretation:

Site 130, photo 2: Close-up of several enclaves with linear and circular cropmarks. It is fairly likely that these represent archaeological features. This photo suggests that scattered archaeological features may occur over the whole area

Site 175, photo 3:
Close-up of cropmarks in one of the zones. The presumed archaeological features revealed by anomalies in the development of the crops occur in two zones. Oval and circular features are visible. There is a visible broken line creating the impression of a boundary dividing that zone from the rest of the site.

Site 214, photo 1:
Cropmarks are clearly visible along a stream, some of them have a rather regular shape (circular), but others are more or less irregular. It would appear that most of these are archaeological features.

Site 238, photo 3:
On a field where there are practically no cropmarks (even the modern under-draining is only weakly visible), a small circular mark, of about 5-6 m diameter, is visible. Is this a trace of a completely levelled barrow?

Site 238, photo 5:
On a field of ripening cereals, where cropmarks are barely visible, a quadrangular 'feature' a few metres across may be observed. It is atypical, in that the vegetation is shorter (a negative vegetation mark), suggesting that adverse factors hindered the growth of the crop. Within and around this feature are small circular cropmarks (about half a metre in diameter). The shape of the quadrangular feature suggests the plan of a hut.

Site 300, photo 1:
Slight rise separating two valleys, part of it is covered by a standing crop of cereals, while in another area the crop had been cut. Cropmarks in the former area are reasonably clear but difficult to interpret unequivocally. It is fairly likely that the marks visible as higher and slightly brown corn represent archaeological features, and highly likely that they extend into the field where the crop had already been cut.

Site 300, photo 3:
The neighbouring hill. Here again cropmarks are visible in a cereal crop. The irregular zones of anomalies in the colour of the vegetation are probably caused mainly by features of geological origin. The presence however of a few very regular 'features' suggests that archaeological features may also be present.

Site 300, photo 4:
An adjacent rise, again cropmarks are visible in a cereal crop but here they are barely visible. In one place a rectangular 'feature' (a sunken-floored hut?) can be seen.

The results of the analysis were then used during the execution of further stages of the rescue project, mainly during the excavation of the endangered sites.

After a powerful new tool known as GIS became available, it diversified the way air photos are applied by archaeologists as it became possible to integrate the end products of this method with some others, ie. results of surface surveys (fieldwalking) and geophysical examinations on the background of topographical map. The advances which have been made in the last few years in the methods of inventorying and documentation of archaeological sites have taken place mainly due to advances in computer technology. This exceptionally dynamically developing field has supplied exceptional applications of a universal character, and thus of use to the archaeological profession, and especially to the heritage management service. Its everyday professional activities include the rapid selection of data from huge resources of archives and documentation created by the long term programme called the Polish Archaeological Record. For this reason, all archaeologically valid photos from the described project have been rectified and inserted into a topographical 1:10 000 scale digital map in order to precisely locate the archaeological features identified from the air. It was done by use of the shareware software ***Airphotos*** (www.home.t-online.de/home/gcarver/Airphoto.htm. The inevitable condition for the photo to be processed this way is the sufficient number of control points it contains.

Already the use of textual databases meant a great advance over the use of traditional paper records and allowed the automation of the process of creation, updating, and search. After mastering the new tool, users rapidly came to appreciate its many advantages, such as:

- the possibility of establishing and maintaining precise data standards,
- the rapid identification of mistakes and missing information,
- the possibility of automation of part of the work connected with the completion of data and correction of mistakes,
- the possibility of the rapid and cheap creation of an unlimited quantity of copies of data in order to safeguard them or disseminate them, or allow their synthesis.

An important argument for the introduction of digital maps in the everyday work of the archaeological conservation services, apart from the time it would save and the increased precision of the obtained results, is also the fact that for some time these tools have been increasingly commonly used by our professional partners, who make use of archaeological data, that is planners, officials of the state and local government as well as several specialised public and communal services. In such situation it seemed justifiable to introduce a systematic solution, the creation of maps of archaeological sites as one of the layers of multiaspectual spatial planning maps. For the archaeological conservation services – apart from any other advantages - this would have an important strategic value, since it would allow the elimination of the frequent procedure of ignoring of the problem of preservation of archaeological heritage in the decision-making process involved in local government, planning of redevelopment, administrative processes etc.

After finishing the project described above we found it useful to prepare an Internet presentation, showing the applied research procedures and to publish it on our WWW page ***Archaeology in Poland*** (fig. 4) to make the method wider known and used (www.muzarp.poznan.pl/muzeum/muz_eng/_archairframe.html). which is one of the products of European project *ArchTerra. Extending the European Archaeology Web over Bulgaria, Romania, and Poland,* carried out by Poznań Archaeological Museum in 1999-2001 under the INCO Copernicus programme (Van Leusen and Prinke 2002).

What remains to be done is (1) a "spade test" to check the results of the possibly all photo interpretations by method of sondages and drilling, (2) an attempt to define the outline of the regional "cropmark typology" for Mid-western Poland, according to its specific environmental conditions (soil, climate, agrocultural technologies).

Fig. 4. Internet presentation, showing the applied proceeding of air photos, published on WWW page ***Archaeology in Poland***

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