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Archaeological Chronology and Excavation Data Bases

Zoltán Czajlik–Balázs Holl

1. The GIS Laboratory of the Institute of Archaeological Sciences, Loránd Eötvös University, Budapest

The GIS Laboratory was established during the archaeological operations associated with construction of the M3 motorway in the section running across Hajdú-Bihar county, by the Archaeological Department of Eötvös University (now the Institute of Archaeological Sciences) with the assistance of the Déri Museum in Debrecen. The task of this laboratory is the fast and reliable documentation of the often huge sites of the motorway excavations.

The elements of this system are as follows:

- an excavation system based on stratigraphic units: it is a mixture of the French stratigraphic data sheet techniques, used first in Hungary on the hill of St. Vid near Velem and drawing with exact grid levelling which proved useful at the site of Polgár - Csőszhalom. In its present form, the stratigraphic unit embodies the basic archaeological unit while features represent the phenomena.
- **the computerized data base** developed from the stratigraphic data sheets. Each record in the computerized data base represents a stratigraphic unit and contains its field data (localisation, type, dating, comments).
- **the digital recording of the excavation survey** made on a scale of 1:20, with the detail drawings, the pathway of the road, and other truely informative map elements (e. g. relief, hydrography) inserted in it. These two units are linked in a computerized way through the stratigraphic numbers, ensuring multi-faceted search possibilities.
- a digital map system which serves in the presentation of the sites' wider environment and the identification of aerial photo positions. The scales chiefly employed are 1:100,000, 1:10,000 and 1:2,000.

The basis of our computerized documentation is the data bound to the geographical place. This is the interface through which the individual subsystems form an integrated system with each other. Through this integrated system additional properly analysed information (e. g. results of the magnetometric geophysical survey) can be encorporated.

All the above mentioned elements do not, of course, add up to GIS. However, in our opinion, they are the indispensable basis for the analysis to follow. At present, our primary task is practical processing (production of maps, documentation of excavations including general drawing, drawings separated into chronological levels, development of the data base as well as the identification of aerial photographs), while the task of analysis can only commence once field research ends.

2. The structural problems of chronological systems in archaeology

The first problem we had to face in developing our data base was that due to the lack of archaeological excavations in the northern part of the Great Hungarian Plain (environs of Hortobágy) no detailed chronological system was available which we could adapt. We could create one by interpolation from the neighbouring areas and survey results with the help of Dr. Pál Raczky and Dr. József Laszlovszky. The next difficulty is that, as is well known, many different chronological systems may be used at the same time. These must be synchronized by computer as much as possible, quite often in the absence of professional consensus.

As many others before us, we classified chronological systems into three main groups: the hierarchical, the absolute and the cultural system (Fig. 1).

The hierarchical structure is most traditional and perhaps the most static approach. It is characterized by all the features of the geological paradigm based on the principle of horizontality as explained by Nicolaus Steno, the Danish-born physician at the court of the Grand Duke of Tuscany in 1669. Although in practice archaeologists use this method only when absolutely necessary, it is easily adaptable for computer processing. While the structure based on absolute chronology similarly lends itself to easy computerization, the problem is that it is only very rarely available during the course of excavations. Never-the-less, this system should not be ignored since numerous "absolute" data are provided by scientific methods such as ^{14}C assessments and dendrochronology. Naturally, the cultural structure developed by archaeologists is the most complex since it attempts to follow change both in time and space. (Fig. 2 shows some theoretical possibilities for connections between archaeological cultures). It is not an easy task to adopt this typical archaeological system to the computer, especially if one considers the problems of synchronisation between chronological systems based on pottery styles. The special problem of transitional periods must also be mentioned here. In our case it was primarily of practical concern, since levels cannot always be precisely separated merely on the basis of ceramics within this structure.

3. The data base structure of archaeological periods

This sub-system within our data base was structured without the intention of solving the aforementioned archaeological/chronological problems, leaving them to the specialists. Our system was designed to accomodate modifications following the complete archaeological evaluation of the ceramic material and the acquisition of scientific dates. Our computerized chronological sub-system enables us to communicate freely between the chronological structures detailed above and the possibilities of crossing between structures can also be modified. The technical solution to this problem is the combined use of the hierarchical system of relative chronological units synchronized with slipped time intervals (Fig. 3-4).

4. The hierarchical system of chronological units

All expressions used in archaeological dating corresponds to a chronological unit in our data base. These are, as seen in Fig. 3, organized into 9 types (period, age, stage, transitional, century, absolute time, culture, phase, sub-phase). Thus, thanks to the hierarchical system into which the chronological units are organized as well as the hierarchies established even within pottery types, the questioning works automatically through the entire data base. So the system "knows" that, for example, the Bükk culture is one of the sub-phases of the Alföld Linear Pottery culture, which belongs to the middle Neolithic etc. Therefore the list concerning the Neolithic period contains not only the records assigned to Type 2 as "Neolithic" (see Fig. 3), but hierarchically arranged relevant chronological units from Types 3 to 9 as well.

5. Slipped chronological intervals

The system synchronizes chronological units not with fixed beginnings and ends, but using data from the archaeological literature in an slipped interval system. Thus, the opening of a chronological unit represents an interval between two dates and, similarly, the end of the same chronological unit is defined by an interval. (From the viewpoint of the system itself the accuracy of dates is irrelevant; Fig. 4).

The problem outlined here is, in fact, not a matter of computer application. It is much more a question of archaeological theory and method. Therefore we would like to emphasize that this system should be distributed both geographically and archaeologically as fast as possible. This expansion has neither theoretical nor practical limits. In deciding problems of synchronisation all comments and suggestions by colleagues are welcome. With this help we hope that, in addition to the digital maps already existing and under development elements of a genuine archaeological GIS will be created and a computerised chronological structure of the entire Carpathian Basin synthesized.

Acknowledgements

This project has been supported by *OTKA* Grant No. F6968 of the National Reseaerch Foundation and by the Soros Foundation. The English text was revised by Dr. Alice M. Choyke.

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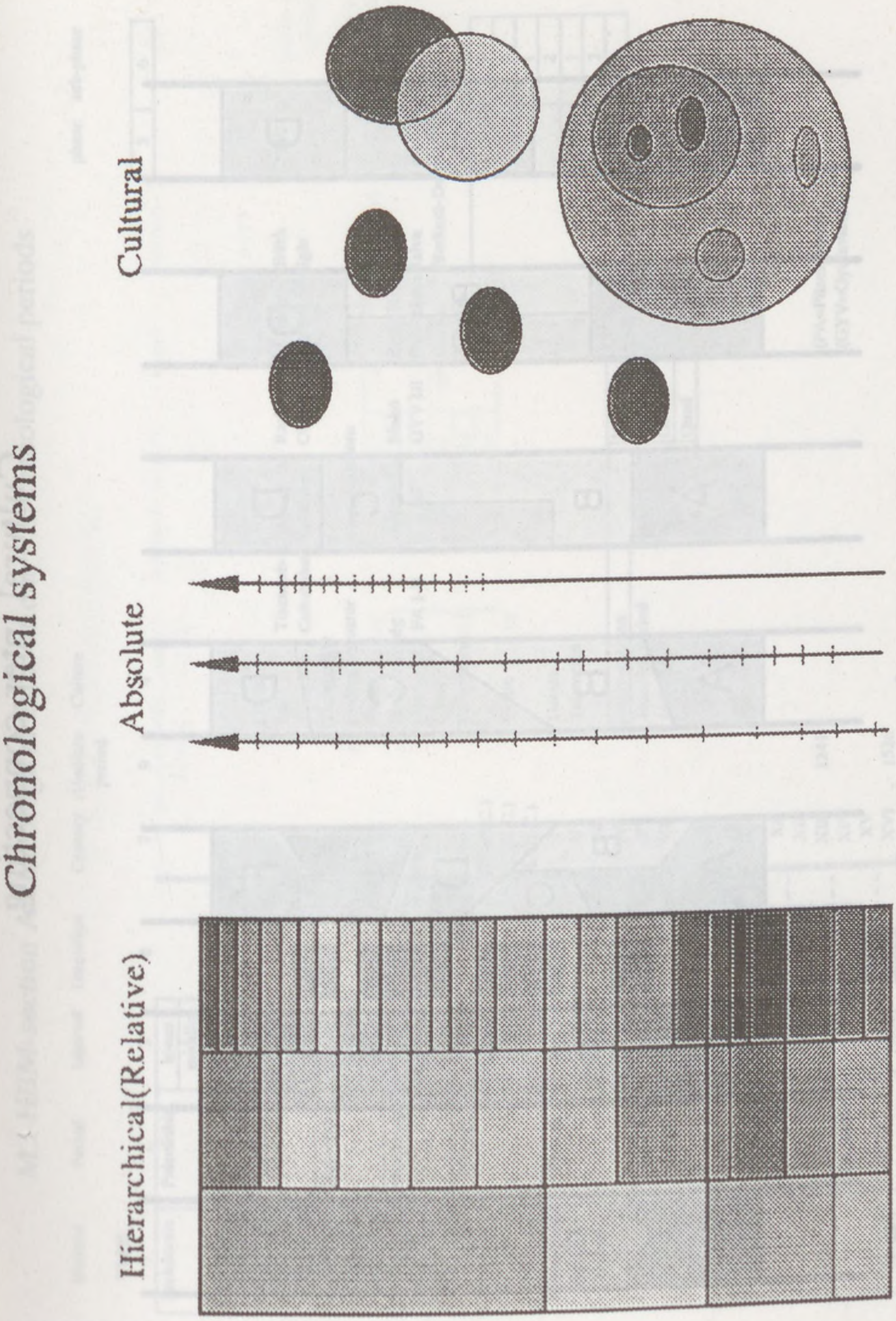
Chronological systems
Hierarchical(Relative)
Absolute
Cultural

Fig. 1

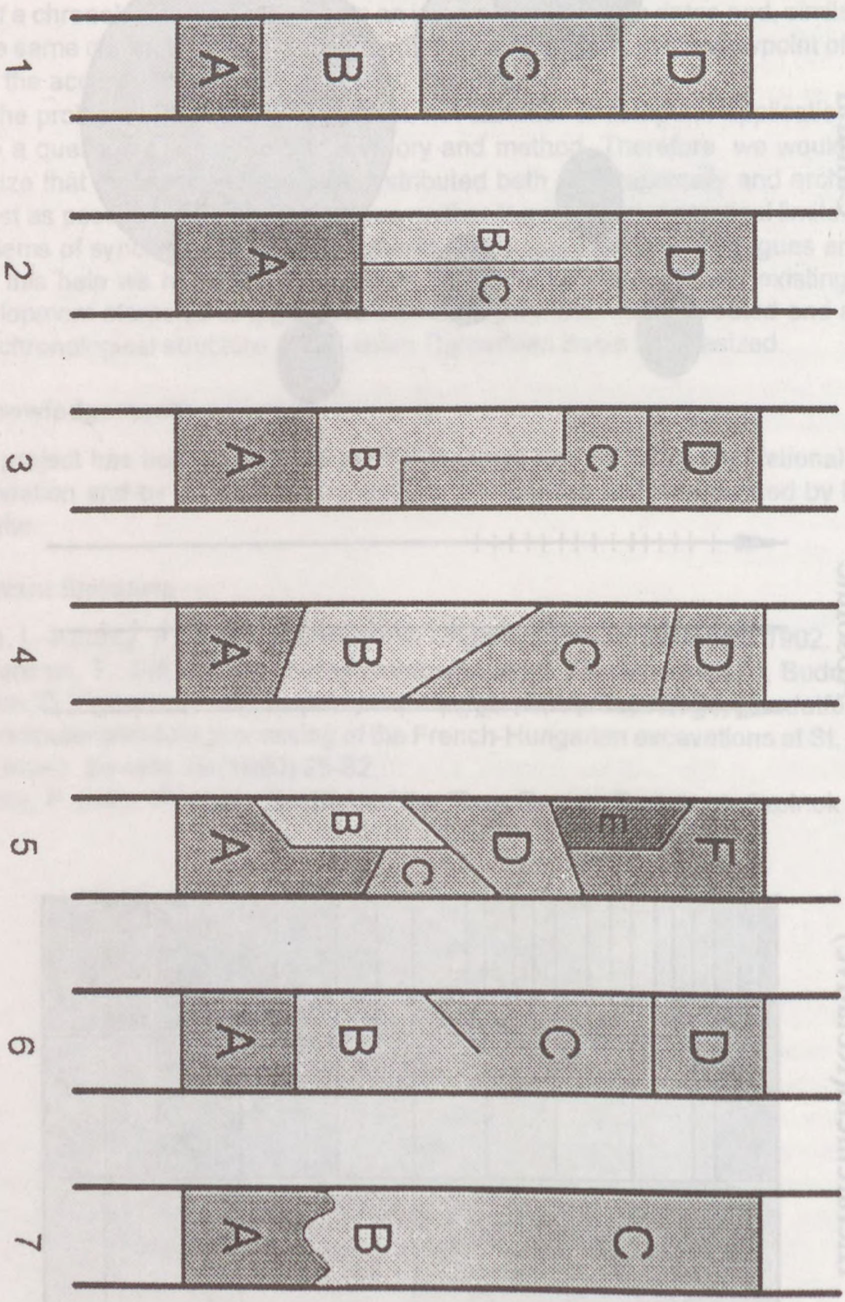

Fig 2

Cultural inter-connecting

M3-HBM-section Archaeological excavations - Archaeological periods

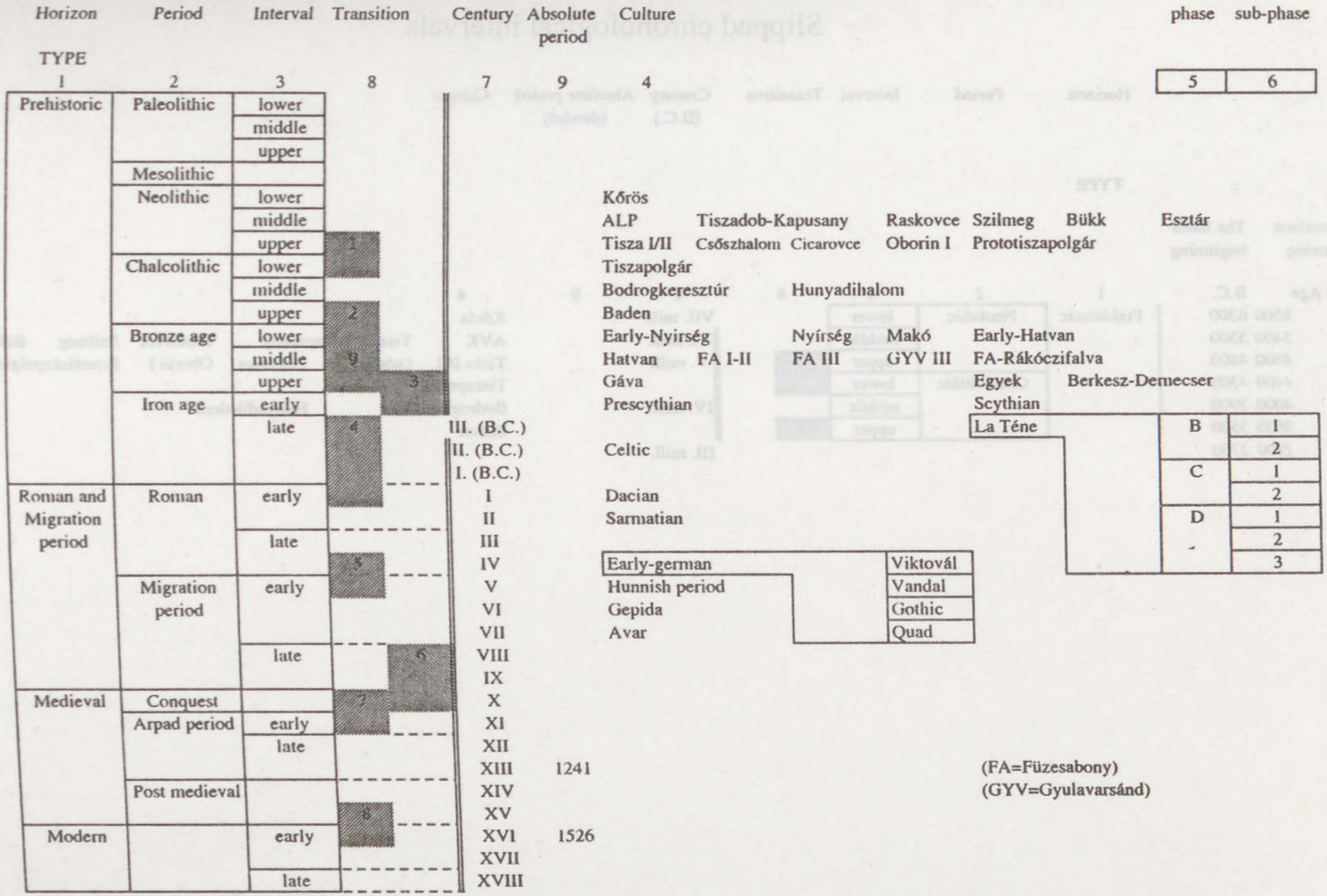

Fig. 3

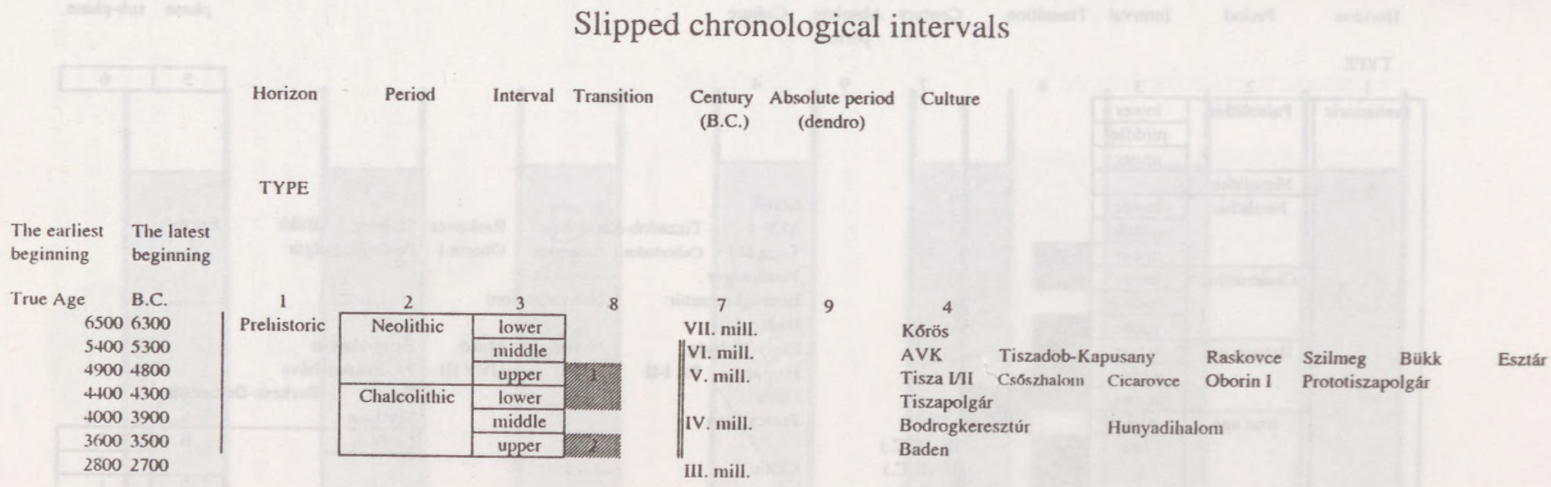
Slipped chronological intervals
Horizon
Period
Interval
Transition
Century (B.C.)
Absolute period (dendro)
Culture
TYPE
The earliest beginning
The latest beginning
True Age
B.C.
1
2
3
8
7
9
4
6500 6300
5400 5300
4900 4800
4400 4300
4000 3900
3600 3500
2800 2700
Prehistoric
Neolithic
Chalcolithic
lower
middle
upper
lower
middle
upper
1
2
VII. mill.
VI. mill.
V. mill.
IV. mill.
III. mill.
Kőrös
AVK
Tisza I/II
Tiszapolgár
Bodrogkeresztúr
Baden
Tiszadob-Kapusany
Raskovce
Szilmeg
Bükk
Esztár
Csőszhalom
Cicarovce
Oborin I
Prototiszapolgár
Hunyadihalom

Fig. 4.