

The Thorikos Excavations 1963 – 2010 in Maps

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Since 1963, the ancient site of Thorikos has been the subject of many research campaigns, which have produced a large amount of cartographic material. The results of these campaigns have been published extensively. Especially noteworthy are the preliminary reports (*Thorikos* I-IX), which include numerous manually drawn maps, generally focussing on particular *insulae* or other structures in Thorikos. In contrast, no high quality overview plans have previously been included (with the exception of the low-detailed situation plan shown on **Fig. 1**).

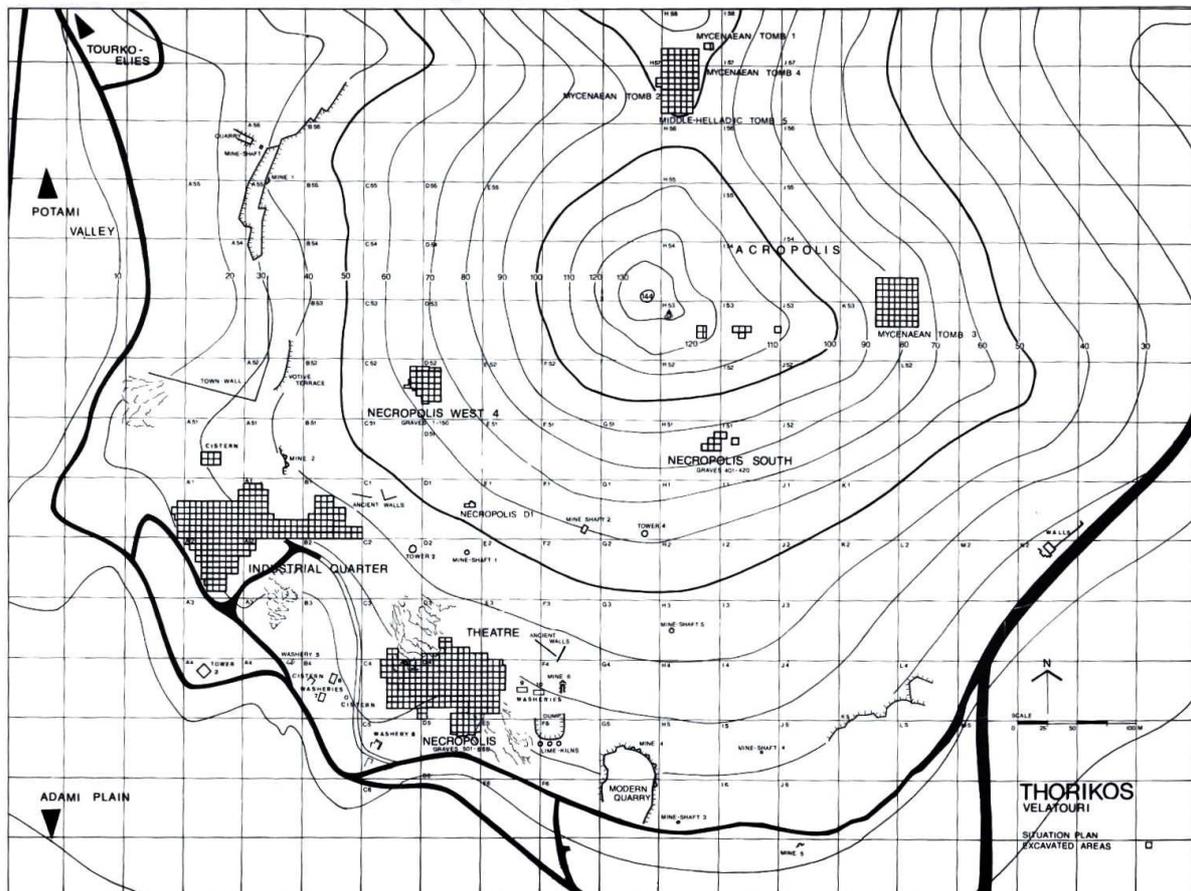


Fig. 1. Thorikos. Old situation plan of the excavations on the Velatouri Hill (version 1998).

The maps published by H. Mussche (1998), which had been prepared by D. Vanhove on the basis of earlier maps by many members of the Thorikos team,¹ were a

¹ One may mention the work of o.a. B. Christides, L. Van Damme-Renard, Cl. Zerck-Mulder, H. Gasche, J. Rawoens, M. Mouraux, A.M. Uyttendaele, A. Bellens, J. De Geyter, and especially L. Demeyer.

reasonable attempt to improve this situation, at least for particular zones such as the Industrial Quarter (Figs. 2-3). However, because of the far-reaching simplification of the archaeological structures, a considerable amount of detail and, hence, crucial information was lost in these maps.

Owing to this, the interpretation of the organisation of the archaeological remains was sometimes hard, especially for scholars who did not have immediate access to the excavation archives at Ghent University. After 1989, the excavation campaigns came to a temporary halt (but see Van Gelder, this volume) and attention was directed to the organisation of the inventories, material study and the creation of a database. During this phase, the need for proper maps and most of all, digitized material became increasingly pressing. Besides preservation issues that urgently needed to be considered, it was also essential to publish coherent and highly detailed cartographic material that could be a basis for future archaeological, geographical and geomorphological analyses.

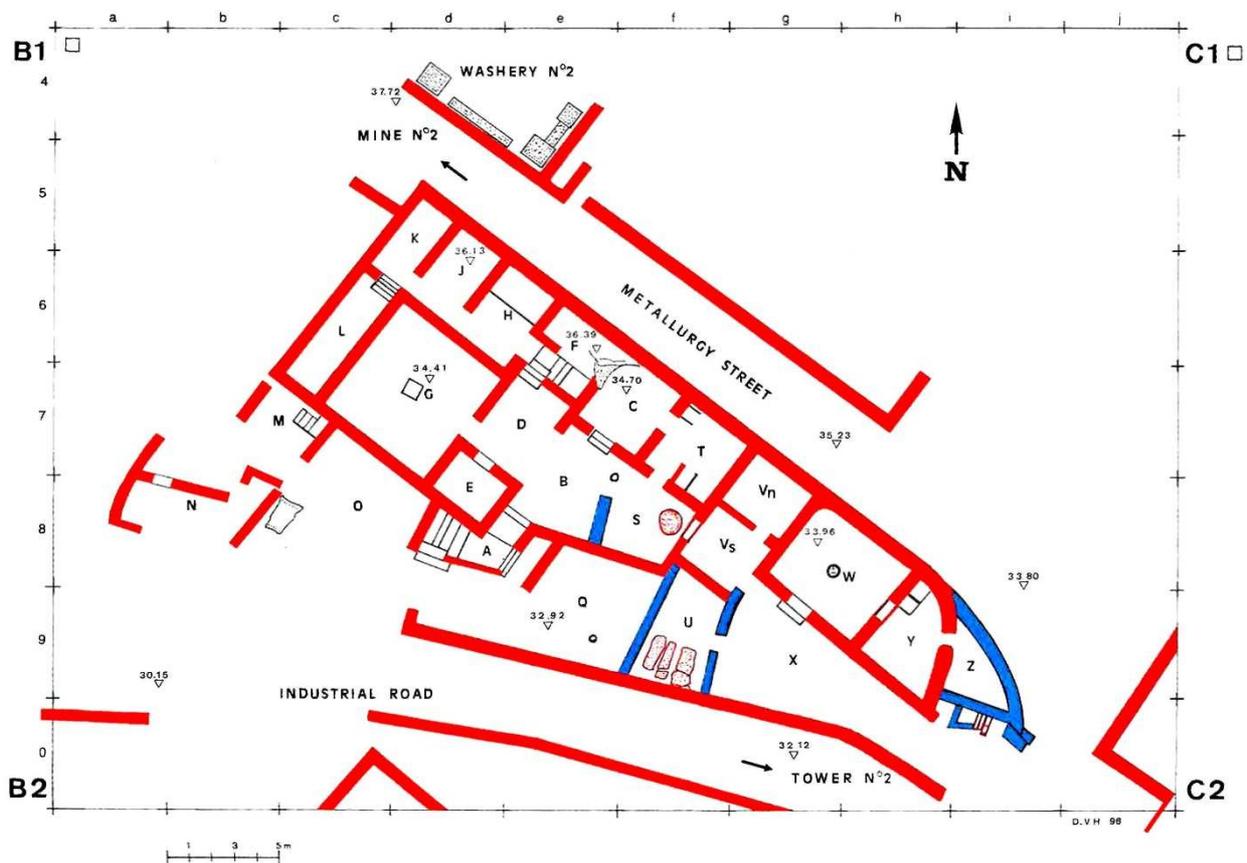


Fig. 2. Thorikos. Example of map published by H. Mussche (1998, 139, fig. 93: “Plan of house no. 1. Blue: structural alterations”).

In 2008, a topographic survey campaign was organised with a view to the systematization and digitizing of all available cartographical data. In order to fully understand how a systematic revision of the old Thorikos maps could be achieved, the history of topographical work at the site and its surroundings should be briefly outlined.

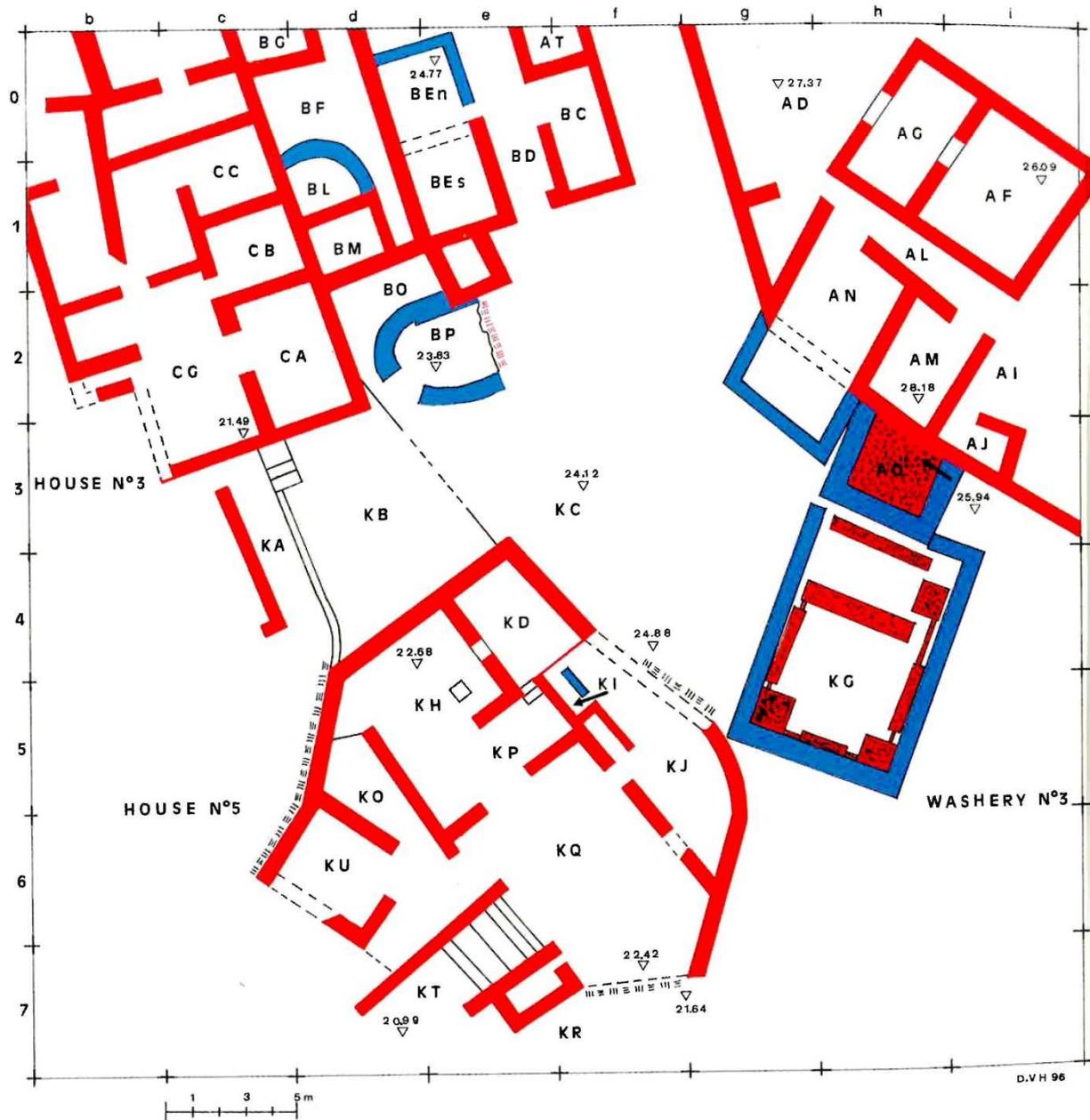


Fig. 3. Thorikos. Example of map published by H. Mussche (1998, 149, fig. 111: “Plan of the area south of insula no. 3. Red: 5th cent. BC.; Blue: 4th cent. BC.”).

Initially, the topographic measurements of Thorikos were all aligned within a local reference system. This system was based on a materialized grid on the Velatouri hill, consisting of ‘macro-squares’ measuring 50m by 50m and containing more than 120 reinforced concrete numbered poles (marked A1, A2, etc.) to define the intersections; the old overview maps hence show the mentioned raster (see e.g. **Fig. 1**). With the absence of easily accessible absolute measurement devices and/or systems, this technique of compact local reference points proved reliable during the fieldwork for many decades. The mentioned macro-squares were subdivided into excavations units measuring 5m by 5m and all archaeological plans were drawn using this grid system as

a basis. Unfortunately, as a result of the unfavourable weather and environmental conditions and the lack of structural maintenance of the grid, many of the concrete poles are currently in a very bad condition. To overcome the ensuing geometric errors, the use of a (differential) global navigation satellite system ([d]GNSS) was introduced on site in 1997, enabling the measurement of points with absolute coordinates (De Wulf *et al.* 2000a; 2000b). The implementation of this measurement technique would leave the local concrete grid theoretically redundant from a technical point of view. Nevertheless, the utility of the grid is still of great importance for the fast local positioning of excavated remains and objects during and after excavation. Also in view of the archaeological survey of the Velatouri hill, which is envisaged for the near future (2012), the grid will still prove to be a useful tool.

After the introduction of absolute satellite positioning for academic purposes by Ghent University, three topographic survey campaigns have been conducted at Thorikos. The first campaign took place in September 1997 and resulted in a data set containing almost 55,753 points covering an area of approximately 7 km² in the valley between Lavrio and Plaka. These points were measured using two different GNSS (Global Navigation Satellite Systems), more precisely the Leica SR20 receiver with external antenna and the Pentax R-1200 systems. During this campaign, a reference station was installed on the roof of the building of the then 'Belgian School' (the 'Kephalou Melatron'). This building is located a few hundreds of meters southwest of the Thorikos site (see *Thorikos* VII, 6, fig. A; De Wulf *et al.* 2000a, 194, fig. 7). The point set has been processed during 'post processing', resulting in a series of points in a local system, WGS84 and UTM.

The second campaign was executed in October 2005 in collaboration with the University of Liège (R. Laffineur) and consisted of a detailed measurement on the northern flank of the Velatouri hill. The Leica SR20 GNSS system was used again, accompanied with a Pentax PCS-300 total station. 2322 detail points and the structures of the Bronze Age tombs on the northern mountain flank were measured and overlaid with a geophysical prospection of the same area. All measured points have also been transferred to the local coordinate system.

The available geo-archaeological data sets of the Thorikos area have been acquired between 1964 and 2010 and are linked with different reference systems. Next to the already mentioned local grid system, different other national, worldwide and local reference systems have been assigned to different data sets. The measuring and referencing of the local grid by (differential) GNSS enable the alignment of all archaeological objects and remains on site within one absolute reference system and increase the interchangeability of different data sets. However, to accomplish this streamlining, the quality of the materialized grid must be monitored.

During a third topographic survey campaign in April 2008, a Pentax R-325 N reflectorless total station was used to check the geometric quality of the concrete grid markers, next to a visual qualification of these poles. During the same campaign, preparatory work took place for archaeological research on the ancient water management of the area. Within this context, Cistern no. 1 in the northern part of the

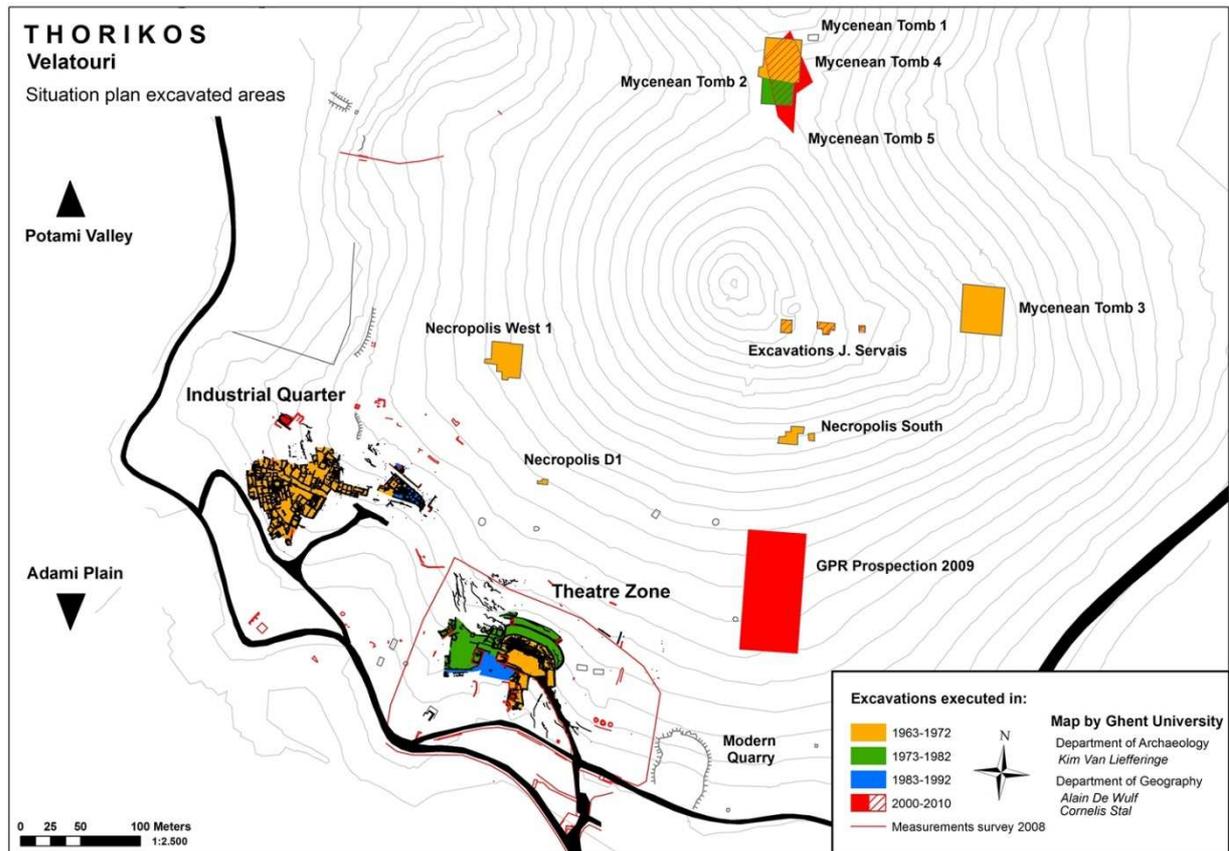


Fig. 4. Thorikos. Revised situation plan of the excavations and other fieldwork on the Velatouri hill (situation: 2010). Note that the zones marked ‘Excavations J. Servais’ have been revisited in 2000.

industrial area has been measured intensively (see Van Liefferinge *et al.*, this volume). Some of the principal structures in the Theatre Zone have been measured as well, but in this area the focus had been rather on modern structures, like roads and fences. All measurements were performed from free stations, where the position of the total station is based on the measurement of at least three grid poles. Each series of measurements contains a set of polar coordinates, processed by Octopus survey software. Rectangular coordinates of the measured objects are calculated by aligning the free stations with the reference point set of the grid poles. These calculations are executed in post processing, in order to perform a least squares adjustment of the data.

The latter topographic survey was necessary to allow the synchronization and digitizing of all available (manually drawn) archaeological maps. The plans were scanned, processed in Photoshop and accordingly vectorized and georeferenced in ArcGis. They contained the materialized grid, as well as highly detailed information about the site on single stone level in the case of architectural structures. By combining the data on these maps with the topographic survey results, verification and a visual geometric analysis was possible. It showed that all archaeological maps prepared over the past decennia were remarkably accurate.

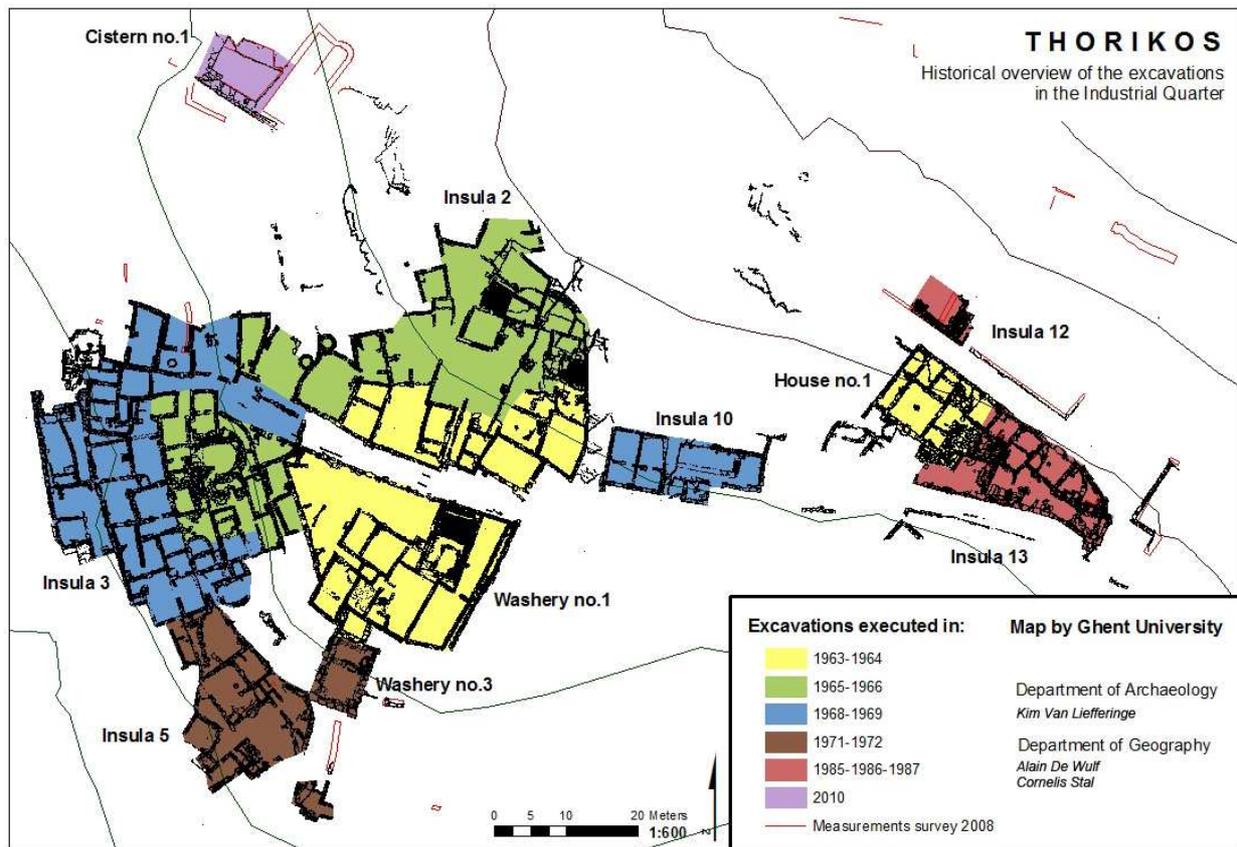


Fig. 5. Thorikos. Historical overview of the excavations in the Industrial Quarter (situation: 2010).

One of the most important results of these activities was the creation of a new overview map of the Velatouri hill, showing a situation plan of the excavations, which were executed from 1963 until 2011. Similar maps were prepared of the Industrial Quarter and the Theatre Zone (Figs. 4-7). Especially Fig. 7 that shows the same *insula* as on Fig. 2 nicely illustrates the potential of the plans in comparison. It should go without words that the composition of an overview map is to be considered as a work in progress. For now, only the Industrial Quarter and the Theatre Zone are incorporated in detail (see also Mortier, this volume, fig. 1). Other areas (among others the cemeteries) are temporarily indicated as on the old maps. The actual drawings of these zones will be digitized and included to the general plan in the near future.

Fig. 7. Thorikos. Industrial Quarter, House no. 1 (situation 2008).

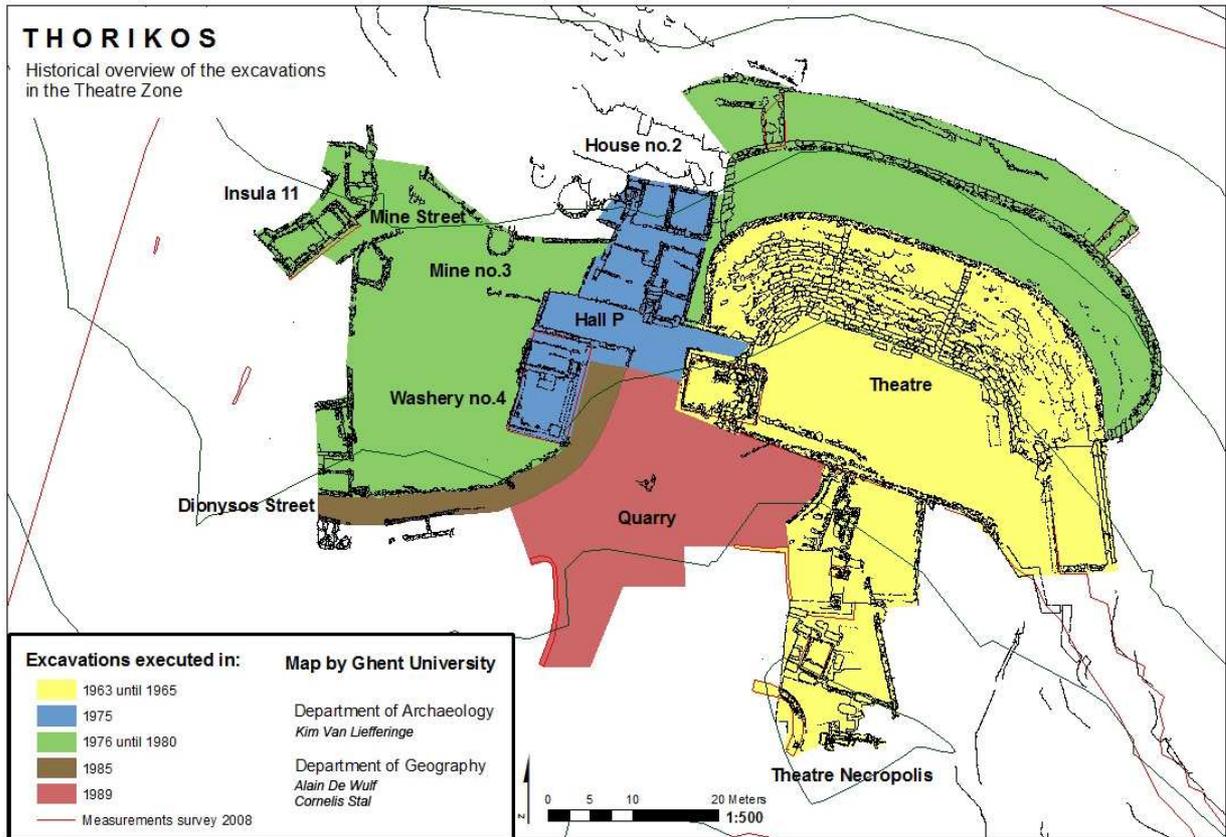
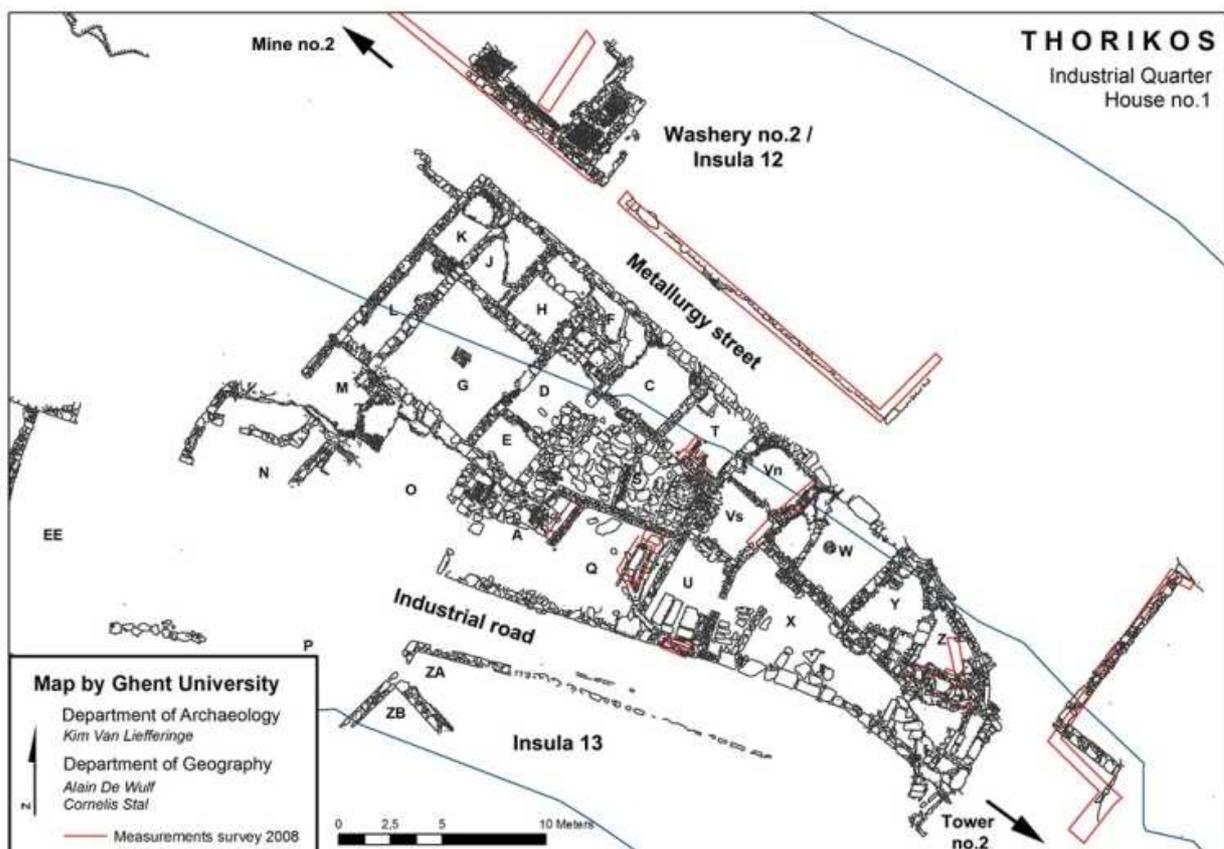


Fig. 6. Thorikos. Historical overview of the excavations in the Theater Zone (situation: 2010).



References

- De Wulf A., Van Herck T., De Dapper M., De Vliegheer B.M., 2000a, GPS Surveying Techniques in Archaeology: Topographical Survey of the Thorikos Region (Greece), in: F. Vermeulen, M. De Dapper (eds.), *Geoarchaeology of the Landscapes of Classical Antiquity. Géoarchéologie des paysages de l'Antiquité Classique. International Colloquium Ghent 23-24 October 1998. Colloque International Gand 23-24 octobre 1998* (BABESCH Supplement 5), Leuven, 189-196.
- De Wulf A., Van Herck T., De Dapper M., De Vliegheer B.M., 2000b, Analysis of the Efficiency in Archaeology of GPS Satellite Surveying versus Classical Surveying using Totalstations: Applications in the Thorikos Region and on the Pyrgari (Greece), in: F. Vermeulen, M. De Dapper (eds.), *Geoarchaeology of the Landscapes of Classical Antiquity. Géoarchéologie des paysages de l'Antiquité Classique. International Colloquium Ghent 23-24 October 1998. Colloque International Gand 23-24 octobre 1998* (BABESCH Supplement 5), Leuven, 197-207.
- Mussche H. 1998, *Thorikos. A mining town in ancient Attika* (Fouilles de Thorikos II / Opgravingen van Thorikos II), Gent.
- Mugnier C., 2002, Grids and Datums. The Hellenic Republic, *Photogrammetric Engineering & Remote Sensing* 68,12, 1237-1238.
- Thorikos* I: Mussche H.F., Bingen J., Servais J., Paepe R., Hackens T., 1968, *Thorikos 1963. Rapport préliminaire sur la première campagne de fouilles. Voorlopig verslag over de eerste opgravingscampagne*, Bruxelles/Brussel.
- Thorikos* II: Mussche H.F., Bingen J., De Geyter J., Donnay G., Hackens T., 1967, *Thorikos 1964. Rapport préliminaire sur la deuxième campagne de fouilles. Voorlopig verslag over de tweede opgravingscampagne*, Bruxelles/Brussel.
- Thorikos* III: Mussche H.F., Bingen J., Servais J., De Geyter J., Hackens T., Spitaels P., Gautier A., 1967, *Thorikos 1965. Rapport préliminaire sur la troisième campagne de fouilles. Voorlopig verslag over de derde opgravingscampagne*, Bruxelles/Brussel.
- Thorikos* IV: Mussche H.F., Bingen J., Servais J., Paepe R., Donnay G., 1969, *Thorikos 1966/1967. Rapport préliminaire sur la quatrième campagne de fouilles. Voorlopig verslag over de vierde opgravingscampagne*, Bruxelles/Brussel.
- Thorikos* V: Mussche H.F., Bingen J., Servais J., Paepe R., Bussers H., Gasche H., 1971, *Thorikos 1968. Rapport préliminaire sur la cinquième campagne de fouilles. Voorlopig verslag over de vijfde opgravingscampagne*, Bruxelles/Brussel.
- Thorikos* VI: Mussche H.F., Bingen J., Conophagos C., De Geyter J., Paepe R., Vandenven G., Deraymaeker D., 1973, *Thorikos 1969. Rapport préliminaire sur la sixième campagne de fouilles. Voorlopig verslag over de zesde opgravingscampagne*, Bruxelles/Brussel.
- Thorikos* VII: Spitaels P., Bingen J., Uyttendaele A., Blondé F., Van Gelder K., Cheliotis A., Helsen A., *Thorikos 1970/1971. Rapport préliminaire sur les septième et huitième campagnes de fouilles. Voorlopig verslag over de zevende en achtste opgravingscampagnes*, Gent 1978.

Thorikos VIII: Mussche H.F., Bingen J., Servais J., Spitaels P., Thorikos 1972/1976.

Rapport préliminaire sur les 9^e, 10^e, 11^e et 12^e campagnes de fouilles. Voorlopig verslag over de 9^e, 10^e, 11^e en 12^e opgravingscampagnes, Gent 1984.

Thorikos IX: Mussche H.F., Bingen J., Jones J.E., Waelkens M., Thorikos 1977/1982.

Rapport préliminaire sur les 13^e, 14^e, 15^e et 16^e campagnes de fouilles. Voorlopig verslag over de 13^e, 14^e, 15^e en 16^e opgravingscampagnes, Gent 1990.

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