LANCASTER
UNIVERSITY
ARCHAEOLOGICAL
UNIT

September 1999

# TEL AKKO
# ISRAEL

## Topographic Survey Report

Undertaken for: University of Haifa

# Tel Akko,
# Israel

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Topographic Survey Report

Report no 1999-2000/009/AUA

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| Checked by Project Manager.<br><br>..... Date |
| Passed for submission to client.<br><br>..... Date |


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September 1999

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# ACKNOWLEDGEMENTS

LUAU gratefully acknowledges the support of Professor Michal Artzy and Dr Ann Killebrew who provided considerable assistance in the course of the fieldwork.

The survey was undertaken by Jamie Quartermaine. The CAD draughting was undertaken by Emma Carter and Jamie Quartermaine. The summary report was written by Jamie Quartermaine and was edited by Richard Newman.

 

# 1. INTRODUCTION

## 1.1 CIRCUMSTANCES OF PROJECT

1.1.1 A topographic landscape survey of Tel Akko was carried out by Lancaster University Archaeological Unit (LUAU), on behalf of Haifa University, Department of Maritime Civilisations. This element was undertaken in conjunction with a programme of research excavation being undertaken at Area G by the Department of Maritime Civilisation under the direction of Prof. Michal Artzy and Dr Ann Killebrew. The survey was undertaken between the 16th and 22nd of August 1999. The survey was also required to provide training for Haifa University students in the use of modern survey techniques.

1.1.2 The survey was intended to create a contour map of the surface of the tel and to superimpose on the extent of previously excavated areas. In the event the survey was able to record the full upper extent of the tel, but, because of time restrictions, omitted some of the lower disturbed areas on the southern side of the tel. The three dimensional survey data was used to construct a digital terrain model, and this was used to produce a two dimensional contour depiction of the tel's surface. A three dimensional surface mesh was also created which was rendered within a Computer Aided Draughting (CAD) system.

1.1.3 The present report presents the summary graphic results of the survey and outlines the methodology employed to create the survey results.

# 2. METHODOLOGY

## 2.1 SURVEY CONTROL

2.1.1 The control for the survey was established by closed traverse using a Zeiss ELTA3 total station, and was able to maintain an internal control accuracy of better than +/- 0.05m. The control was orientated with respect to the excavation grid established during the 1970/80's programme of excavations. The local grid was orientated North/South and an arbitrary control point (A1) was defined as 1000,1000. The height datum was taken from an extant bench mark within Area H, but this was originally based upon a sea-level datum defined by a survey bolt in the concrete pad of a former pill box on the highest point of the tel.

2.1.2 The survey established a primary control of six stations (A1, A5, A6, A7, A8, and A9) located around the periphery of the tel, and included the bolt in the pill box (A7). A further seven stations were established as secondary order control stations. The station coordinates are presented as Table 1:

| | East | North | Height |
|---|---|---|---|
| **A1** | 1000.000 | 1000.000 | 22.1610 |
| **A2** | 1050.084 | 1095.170 | 26.6400 |
| **A3** | 1054.718 | 1080.059 | 26.6560 |
| **A4** | 1059.730 | 1080.085 | 26.9360 |
| **A5** | 1057.777 | 1115.673 | 26.7580 |
| **A6** | 992.845 | 1098.279 | 23.9750 |
| **A7** | 1177.352 | 1095.571 | 35.4080 |
| **A8** | 1055.137 | 928.794 | 25.0860 |
| **A9** | 998.209 | 886.432 | 19.5200 |
| **A10** | 1199.098 | 1094.768 | 34.1430 |
| **A11** | 1320.971 | 1002.002 | 25.6060 |
| **A12** | 1113.933 | 955.619 | 28.5410 |
| **A13** | 1186.318 | 947.106 | 26.9750 |

## 2.2 DETAIL SURVEY

2.2.1 ***Level 4 Survey:*** the topographical survey was undertaken to LUAU's Level 4 (*Appendix 1*), which is the most comprehensive record of the archaeological features in relation to the surface topography. It incorporates a limited hachure survey alongside a full computer generated model of the ground surface and is typically enacted when a full survey is needed in conjunction with excavations or in cases where the detailed survey of fragile upstanding earthworks is the only appropriate mitigative measure. The Level 4 survey is designed to record the archaeological site as fully as current technology will allow. It is applied selectively to sites of particular importance and which have a good survival of surface features. It is generated by the adequate provision of three-dimensional survey and is typically of +- 0.05m accuracy.

2.2.2 The Level 4 survey output is generated on CAD which maintains the original accuracy of the survey data and allows flexibility of drawing output at any scale.

The drawing file will record the contour detail at different height separations and the final survey drawings can therefore be tailored to meet any requirements of the client.

2.2.3 The archaeological detail and significant topographic detail was undertaken by EDM Tacheometry using the Zeiss ELTA3 total station and data-logger. A systematic survey coverage of the was created by the placement of survey points on an approximate grid which had a separation of between 6m and 11m. The survey created, within a six day period, 2,200 points over the extent of the area. The survey recorded pertinent archaeological detail and the extent of the previous excavation areas. The edges of the former trenches have become very poorly defined as a result of continued collapse and erosion, and their defined extent on the survey mapping is therefore imprecise.

2.2.4 The digital survey data was transferred from the logger into a survey conversion programme (Microsurveyor). The data was then transferred to a modelling package (DGM3) which created a digital terrain model (DTM) of the tel. The modelling programme provided a two-dimensional contour output for the creation of the base map (Fig 1) and also a three dimensional mesh output for the manipulation of the model. The vertical axis of the DGM was exaggerated by a factor of three, in order to enhance the visual impact of the model.

2.2.5 The contour detail was transferred into a CAD system (AutoCAD14), and was superimposed with topographic detail digitised from a 1:1000 base map provided by the client.

2.2.6 The DTM mesh was input into the AutoCAD 14 system via a DXF format, and in its most basic format is presented as Figs 2 to 4. The rendering of the model was created by forming 3D polylines between the principal lines of the north/south grid and ruled surfaces were created between them. The combined surfaces were rendered within the CAD system and were output as .JPG files and are represented as Figs 5 to 9.

## 2.3 ARCHIVE

2.3.1 A full archive of the desk-top survey and the field inspection has been produced to a professional standard in accordance with current guidelines. The archive will be deposited with Haifa University and a digital copy of the data will be retained by LUAU.

# APPENDIX 1

# LUAU SURVEY LEVELS OF ARCHAEOLOGICAL SURVEY RECORDING

This describes the types of survey appropriate for the various stages of archaeological evaluation undertaken in advance of development as practised by the Lancaster University Archaeological Unit. They are based on survey levels defined by the Royal Commission on the Historical Monuments of England (RCHM(E)) and are in accordance with stages of evaluation defined by the Association of County Archaeological Curators (ACAO 1993).

***Level 1 Survey (Assessment)***

This is a rapid level of survey (Site Inspection in project design) typically undertaken alongside a desk top study as part of the site assessment (ACAO 1993, 14). It is an initial site inspection which helps the local planning authority to consider fully the archaeological implications of a planning proposal and also serves as the basis for undertaking and planning further archaeological work on the site.

The Level 1 survey represents the minimum standard of record and is appropriate to exploratory survey aimed at the discovery of previously unrecorded sites. Its aim is to record the existence, location and extent of an archaeological site. The emphasis for the recording is on the written description which should record type and period and would not normally exceed *c.* 50 words.

The location and extent of the sites is typically shown on 1:2,500 or 1:10,000 OS maps as requested by the client. The extent of a site is only defined for sites greater than 50m in size and smaller sites are shown with a cross.

There are two alternative techniques (Levels 1a and 1b), which provide different accuracy levels and have different applications:

*Level 1a*

The sites are located by manual distance measurement techniques (eg pacing) with respect to field boundaries and provide an accuracy of +- 10m (8 figure grid ref.). The loss of accuracy is offset by the slightly reduced costs; however, it is only appropriate for enclosed land, because of the paucity of usable topographic detail.

*Level 1b*

The sites are located using Global Positioning System (GPS) techniques, which uses electronic distance measurements along radio frequencies to satellites to enable a fix in Latitude and Longitude, which can be converted mathematically to Ordnance Survey National Grid. As long as differential GPS techniques are employed then it is possible to achieve accuracies of better than +- 1m. There is a slightly increased cost implication by comparison with Level 1a survey, but it can be undertaken in most terrains, even some woodland.

***Level 2 Survey (Evaluation)***

Level 2 survey defines the extent of all surface archaeological features on site in relation to topographic elements (e.g. field walls) and accurately defines the extent of the overall archaeological site. It is produced in conjunction with a full objective and interpretative description of the features. The Level 2 survey defines an archaeological context for any trial excavations and shows the location of the trenches in relation to the surface features. This level is used to assess the archaeological significance of the site and serves as the basis, along with other evaluation techniques, for the submission of recommendations to the District or County Planning Officer.

There are two sub-divisions of evaluation survey (2a and 2b), which define different levels of detail and complexity. The appropriate application of these levels depends on the extent of the survey areas, the complexity of the archaeological features and the requirements of the survey product.

*Level 2 survey methodology*

The difference between the two sub-levels (2a and 2b) is primarily in the density of raw data and the detail of the field draughting; and the basic survey methodology is essentially the same. The surveys are undertaken using Total Station survey equipment and are located either using Global Positioning Survey (GPS) techniques or by traverse with respect to Ordnance Survey control. The internal accuracy is typically +- 0.05m but is located with respect to the OS National Grid to an accuracy of +- 1.0m or better.

The survey methodology is designed to enable ease of upgrading of the survey levels as required. All Level 2 survey methods rely upon a permanent survey control and the raw survey data is produced with sufficient accuracy to enable their re-use on more detailed drawings at higher scales than originally intended. Fundamental to this process is that all draughting is undertaken within a Computer Aided Draughting (CAD) environment, which retains the primary accuracy of the raw data and allows flexibility of enhancement. Upgrading from Level 2a to 2b will require the provision of additional raw survey data as well as the enhancement of field drawing, but the upgrading from Level 2b to 3 will only require drawing enhancement, in the field, with respect to the raw survey data.

*Level 2a*
This defines the most basic level of instrument survey and is appropriate for the recording of scattered, low complexity archaeological features, typically those found during an extensive open area survey. Archaeological features are defined in outline and earthworks are shown with only minimal hachure annotation. Topography is for the most part extracted from an OS base, although topographic detail in the vicinity of archaeological features is recorded by instrument survey. The raw survey data is typically captured with sufficient density to enable the mapping of the resource appropriate for a 1:500 or reduced scale output. A requirement to output at a greater scale, would involve the provision of additional survey data and enhanced recording. The record incorporates a basic level of textual description of individual features and an overall interpretative assessment of complete site groups.

*Level 2b*
This enhanced level of evaluation survey recording incorporates a relatively large quantity of raw survey data, which can define the extent and form of individual monuments in considerable detail. The detail of earthworks are defined in sufficient detail, to show the character and form of individual earthworks, but does not provide a full interpretative record. The local topography is recorded in greater detail, but also incorporates OS data where spatially remote from the archaeological features. The primary distinction between the Level 2b and Level 2c survey is in the intricacy of the detail draughting. The Level 2b recording is appropriate for an upgrade of a cairnfield survey, for example, but would be inappropriate for the recording of complex earthworks for which a Level 3 survey would be more appropriate. The level of detail would enable appropriate reproduction up to a scale of 1:250. An upgrade from a Level 2b to a Level 2c survey would not need additional instrument survey data, but would require extensive field enhancement of the CAD record. This basic level of survey would typically be undertaken alongside trial excavation work as part of an evaluation (ACAO 1993). It can serve as a mitigation measure for smaller sites with poor surface survival and should be applied where sites of limited significance are under threat.

***Level 3 Survey (Detailed Recording)***
This is the most detailed level of purely interpretative survey and is equivalent to the RCHM(E) Level 3 survey. It involves very detailed interpretative hachure draughting of surface features and is intended for output at scales of up to 1:50. Because of the intricacy of detailed draughting it is inappropriate for large scale generalised mapping but instead is typically applied to the recording of complex earthworks, which involve considerable spatial analysis. Textually the relationship between individual features is contextually assessed and provides for detailed, internal analysis of a complex site. This is undertaken in addition to the description and overall assessment appropriate for the Level 2a survey.

Surveys undertaken at Level 3 from the outset involve the use of similar basic instrument methodologies as the Level 2b survey, although the draughting is more detailed and analytical. However, if a Level 3 survey is produced by upgrading a level 2b survey, then it is typically possible to use manual field survey techniques to enable the graphic enhancement of the more basic survey. An upgraded Level 3 survey is generally depicted on separate layers from the original Level 2b survey to enable subsequent more generalised output at lower scales if required. The design of the Level 3 survey is designed to be enhanced by the provision of contour detail into a Level 4 surface modelled survey. Subject to the

 

requirements of the ACAO, the Level 3 survey can serve as a mitigative record for intermediary graded monuments.

***Level 4 Survey (Comprehensive Recording)***

Level 4 survey is a comprehensive record of the archaeological features in relation to the surface topography. It incorporates an interpretative hachure survey alongside a full computer generated model of the ground surface enacted when a full survey is needed in conjunction with excavations or in cases where detailed survey of fragile upstanding earthworks is the only appropriate mitigative measure.

The Level 4 survey is designed to record the archaeological site as fully as current technology will allow and is the appropriate mitigation response where significant sites are threatened with destruction. It is applied selectively to sites of particular importance and which have a good survival of surface features.

It is generated by the provision of additional survey data to the Level 2 or 3 surveys and is of an equivalent level of accuracy (+- 0.05m). In many cases only a relatively limited amount of additional data is required to upgrade the Level 2 survey to the full surface modelled Level 4 and therefore this can be an economic recording option.

The Level 4 survey output is generated on CAD which maintains the original accuracy of the survey data and allows flexibility of drawing output at any scale. The drawing file will record the contour detail at different height separations and the final survey drawings can therefore be tailored to meet any requirements of the client.

# ILLUSTRATIONS



 

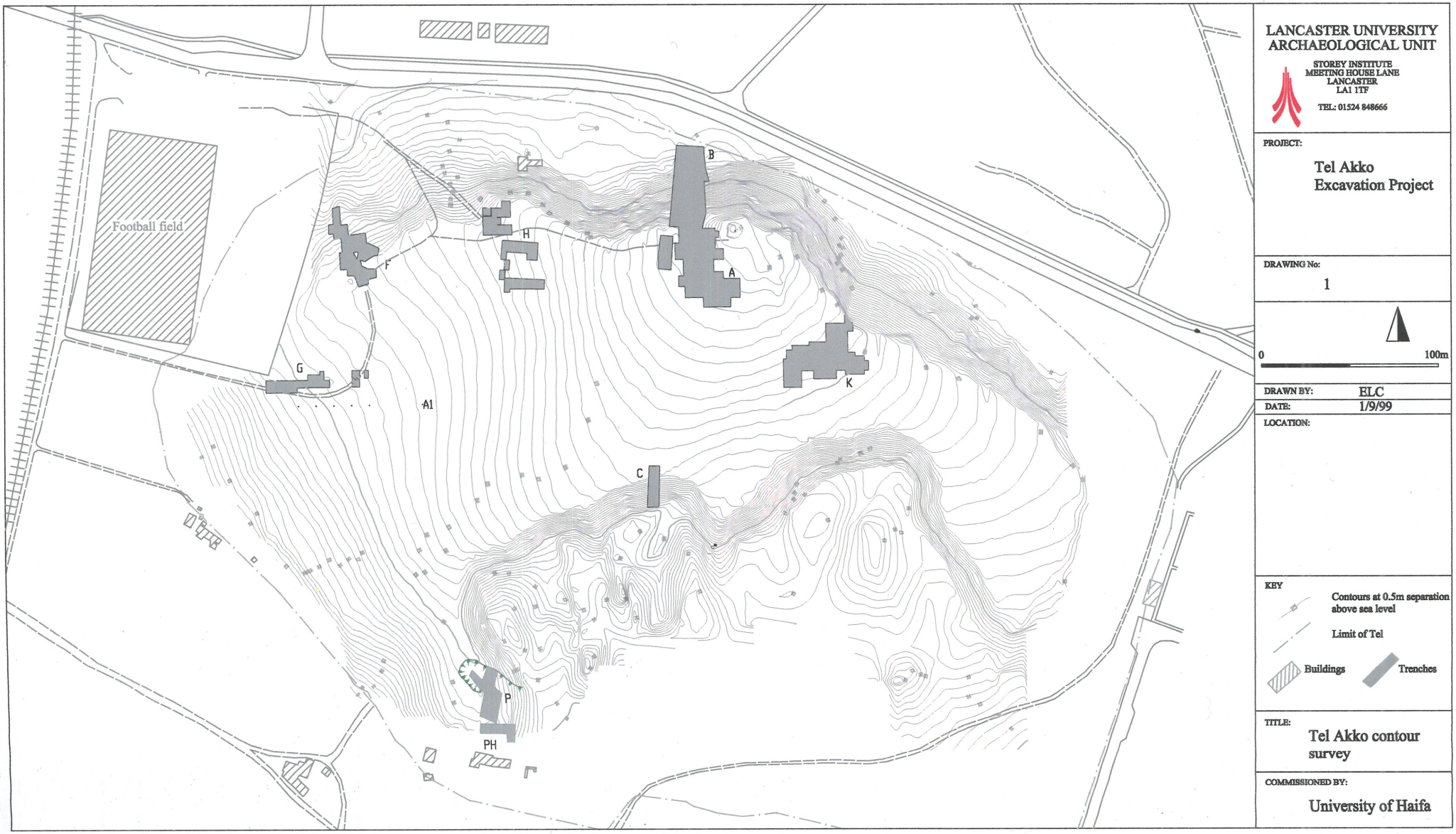


Fig 1 General Contour Map of Tel Akko

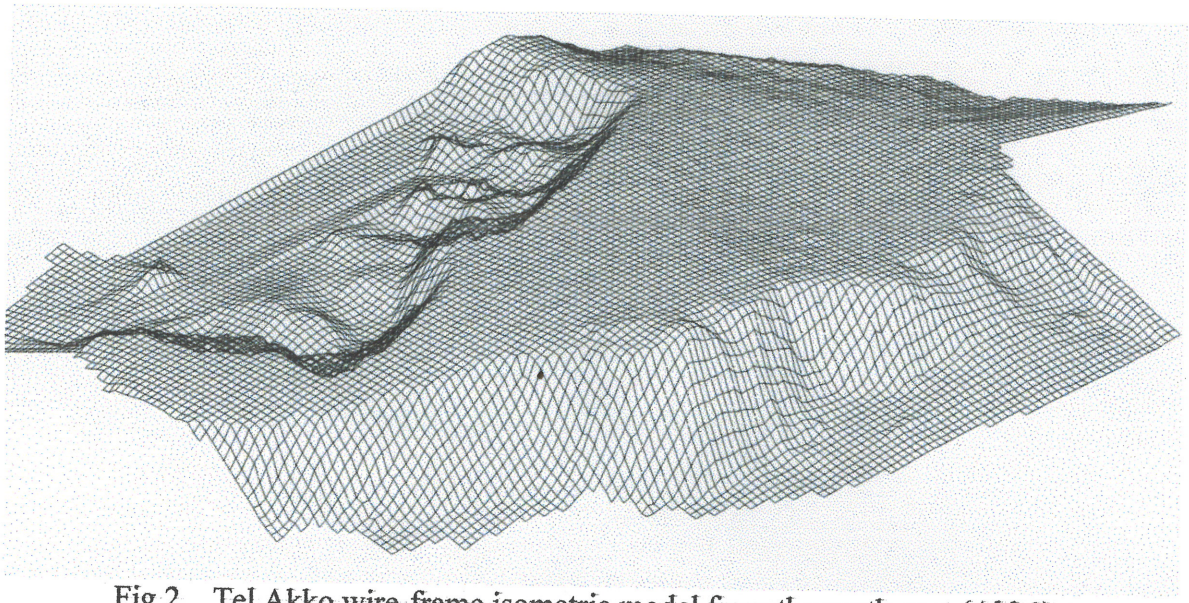

Fig 2 Tel Akko wire-frame isometric model from the north-east (Akk1)

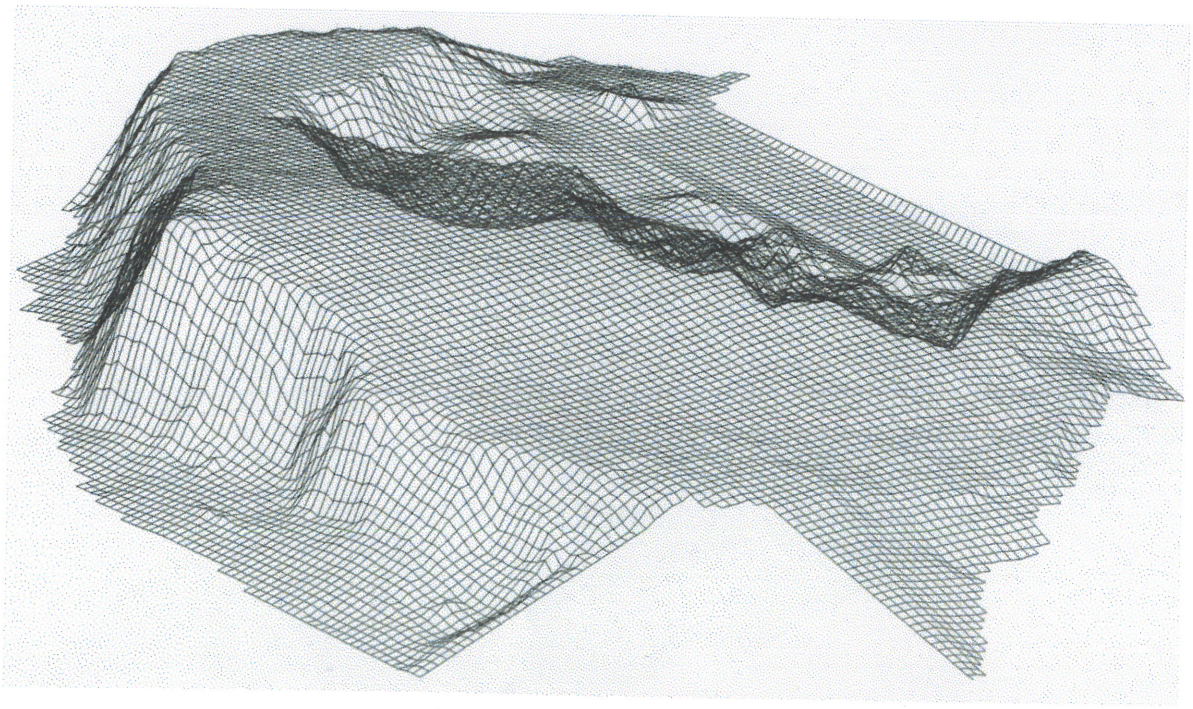

Fig 3 Tel Akko wire-frame isometric model from the north-west (Akk2)

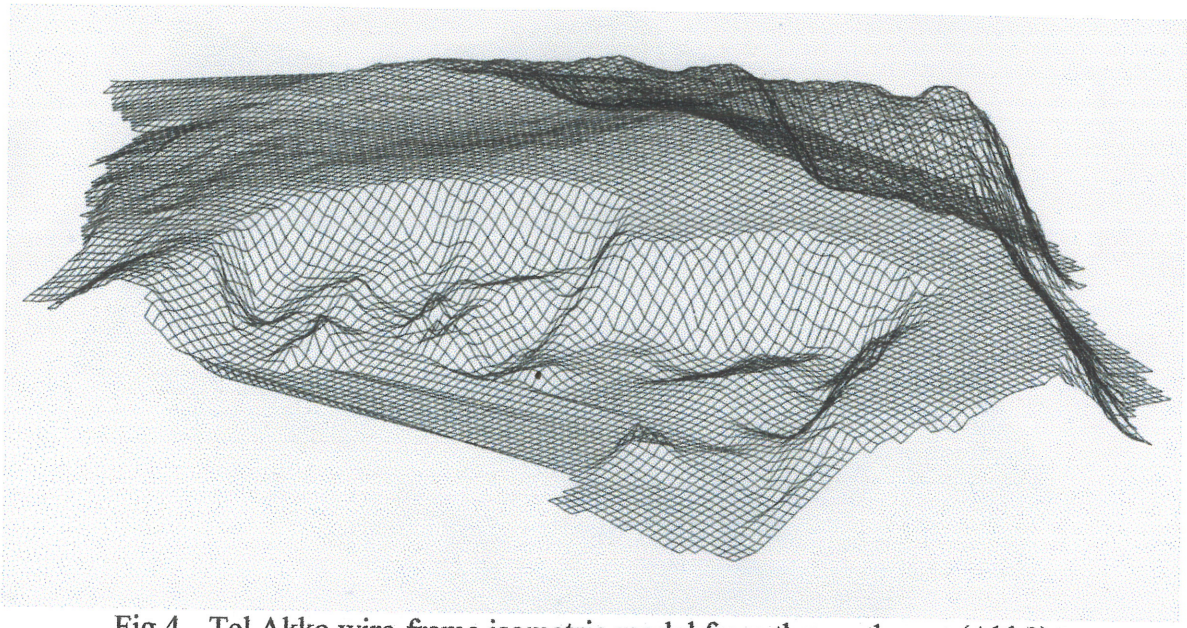

Fig 4 Tel Akko wire-frame isometric model from the south-east (Akk3)

Fig 5 Rendered model of Tel Akko from the south-west (Akkvw1)

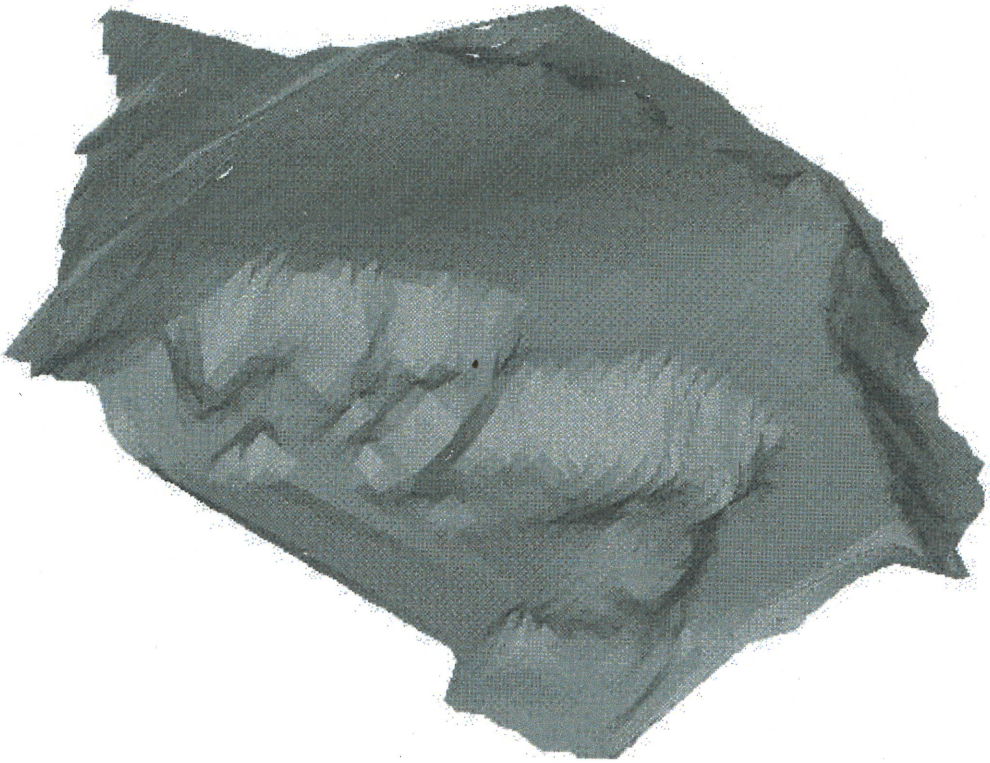

Fig 6 Rendered model of Tel Akko from the south-east (Akkvw2)

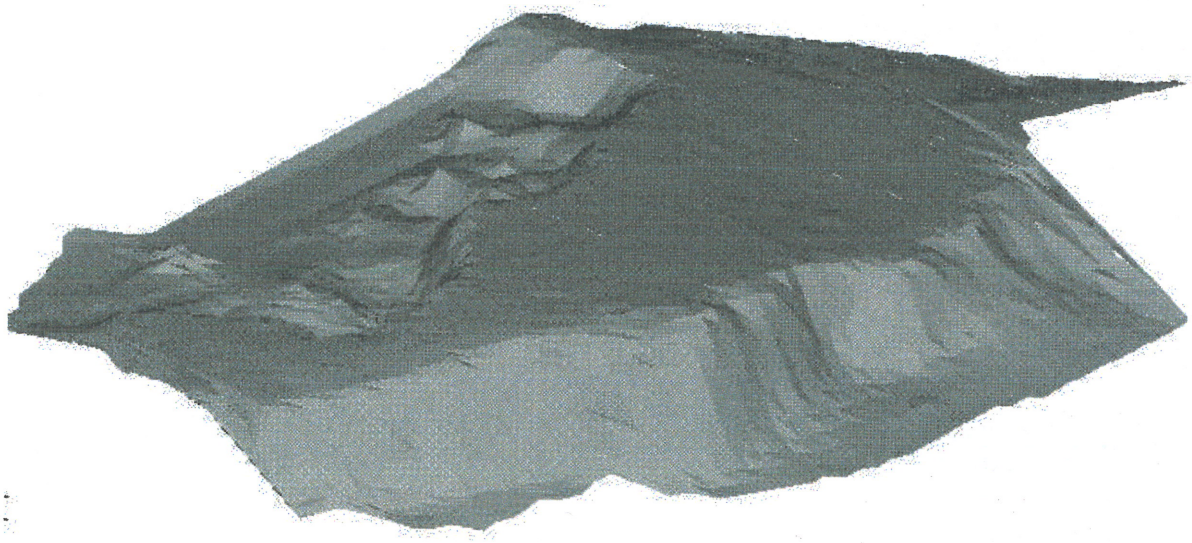

Fig 7 Rendered model of Tel Akko from the north-east (Akkvw3)

Fig 8 Rendered model of Tel Akko from the north-west (Akkvw4)

Fig 9 Rendered model of Tel Akko from ground level looking north (Akkvw5)