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APPLICATION OF GEOINFORMATICS FOR DIGITAL DATA UTILIZATION IN THE FIELD OF ARCHAEOLOGY

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BACKGROUND

Regional characteristics seen today are result of a continuous interaction between environment and human activities. However, "Region" is a complex and ambiguous concept derived from surveyors' point of view. Therefore, region can be defined from various temporal, spatial, and thematic aspects in different scales. The tempo-spatial continuity of region makes the archaeological and historical records to be one of the basic components of our understandings on the region. Hence, Digital Earth like technology which premises the inter-operable use among various spatial data with seamless visualization can be effective to support the understanding of "region". However, the utilization of historical information in these kinds of information platform seems to be still insufficient. On the other hand, recent developments and widespread of open source GIS software, and the digital surveying techniques used in the field works are improving this circumstance. One of the key may be the establishment of systematic flow of dry processing from data acquisition to inter-operable data exchange. The purpose of this research is to propose spatial data obtaining method, and to link the results with inter-operable data utilization in field of archaeology. Spatial data acquisition in archaeological excavation and utilization of excavation reports will be discussed.

APPROACH

Measuring spatial information

Several measurement techniques were examined in archaeological excavation of Tel Ein Gev (Israel). Low cost laser measurement isntrument and photogrammetry was applied to make large-scaled topographic map and the plan of excavated archaeological grids. Stereo paired photo is taken from digital camera attached to the pole with remote shutter trigger. Stereo paired photo is processed with consumer software, and an ortho-rectified photo is generated within several hours after photographing. Ortho-rectified photos itself or traced drawings can be used as a grid plan. Also, 3D data of the excavated grid is acquired at the same time, which can be visualized and observed interactively with CG/CAD software(fig.1).

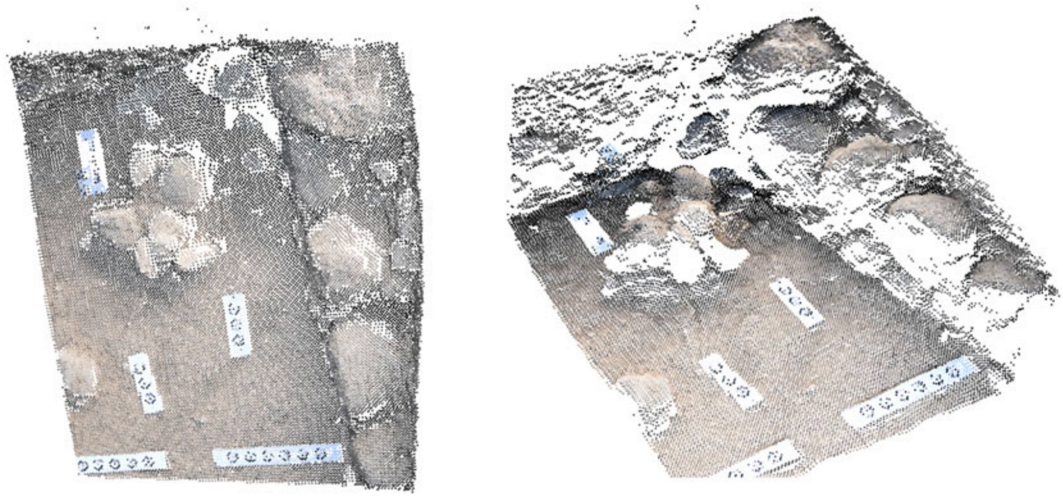

fig.1 3D data generated by photogrammetry

Microtopographic data was collected by automated measuring instrument. Instrument is consisted of non-prism laser device, digital compass, and microcomputer controlled camera platform. Collected data is processed with GIS software to generate Digital Surface Model (fig.2). Finally, contour calculated from DSM, and other spatial data (e.g. housing, streets, etc) are summarized as a large scaled topographic map. Acquired spatial information were integrated into excavation database based on GIS. Once the obtained data are stored as a standardized GIS data sets, it can be easily distributed via internet to be shared and accessed by WebGIS. WMS standard based WMS server software was used for distribution.

fig.2 Relief map generated from DSM overlayed on aerial photo

Utilizing both spatial and thematic information

Spatial information is paired with thematic (attribute) information, which is sometimes much important for archaeology. Thus, not only the utilization of spatial information but also thematic information must be considered. Excavation report, which many of them are now distributed in digital format, is one of the most fundamental data to record and to understand the archaeological site. Data mining / analysis based on Bayesian statistics and morphological analysis were applied. The system learns the surveyors' interests from the initial teaching phase. In this phase, surveyor selects the interested reports and sentences inside them from the teaching interface. After the teaching phase, system will calculate the "weight of interest" of other reports according to the statistical values, and classify the reports from its resemblance and spatial distance. The classified results can be depicted spatially(fig.3). It is expected to show its spatial intensity, which may be implying the regional characteristics and its extent.

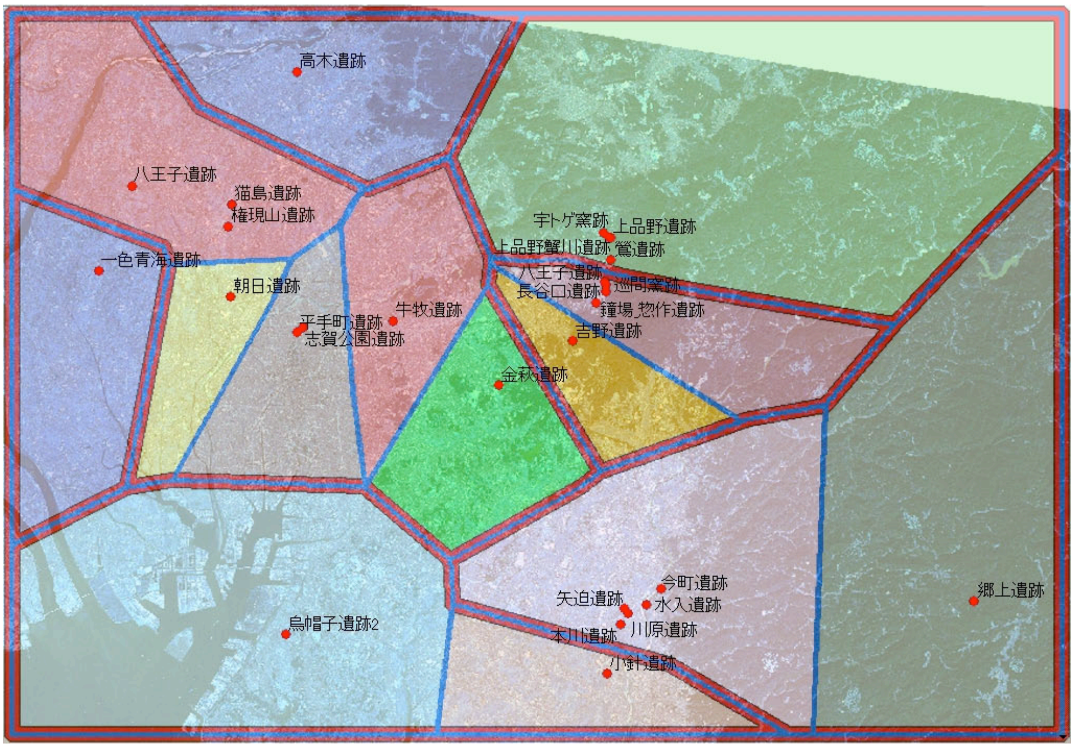

fig.3 mapping of classification result of excavation reports

CONCLUSION AND FUTURE PLANS

Low cost laser scanning and photogrammetry has turned out to be an effective method not only for its rich information (i.e. ortho photo, 3D data, recording microtopography) but also reducing time and man power in archaeological record taking. However, there were still several difficulties under severe condition, such as strong sun light casting shadows which effects the photogrammetric processing, and vegetation covering the surface which increases the error in laser scanning. Data mining techniques from excavation reports were also helpful to manage and gather archaeological records from surveyors point of view. Integration of both methods of spatial data measurement and data mining / analysis can play a significant role to support the interoperable use and deployment of archaeological information(fig.4). It can also be supportive to understand the present status of region as a result of continuous interaction in the area when these archaeological / historical information are uploaded in an inter-operable manner.

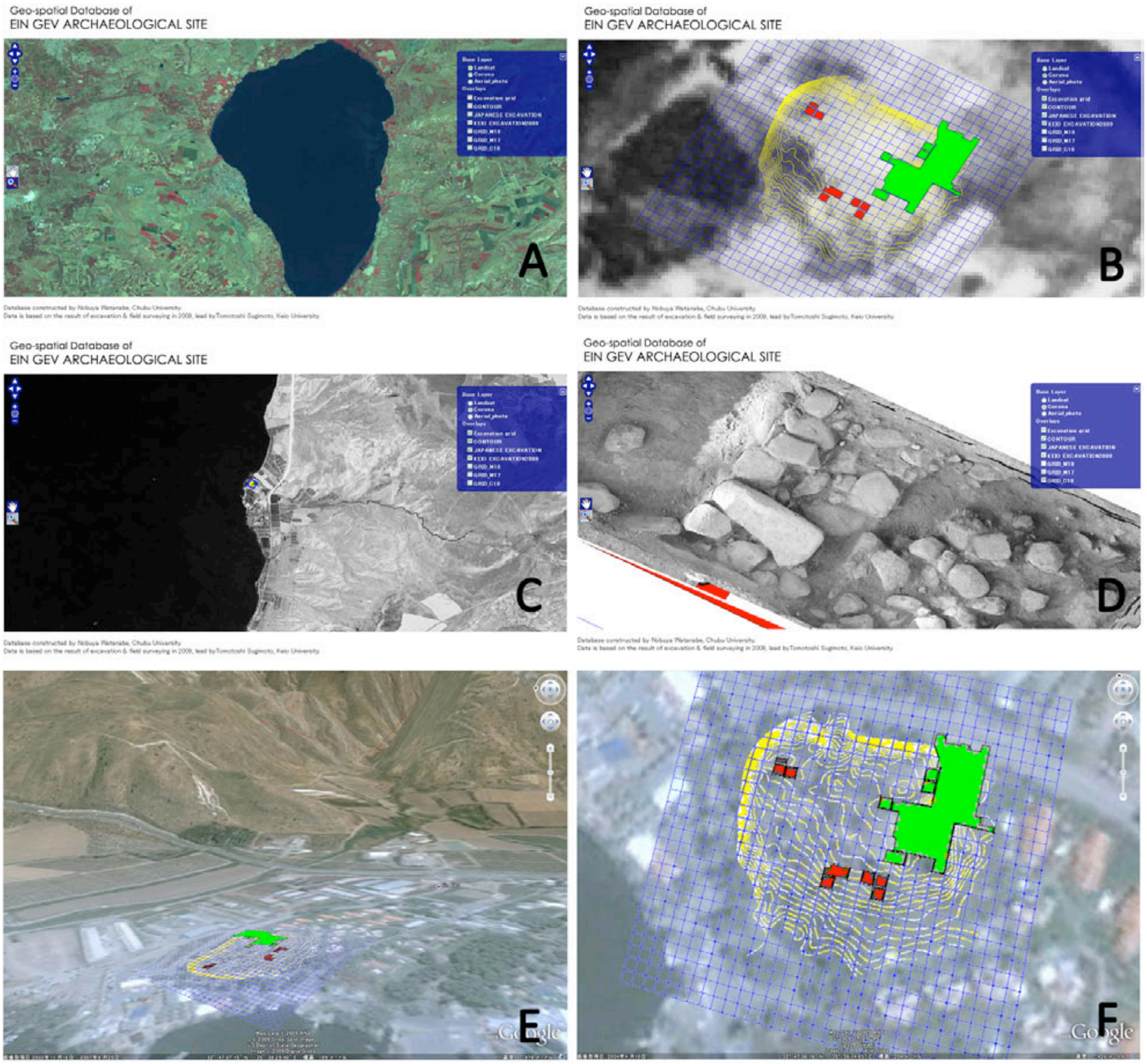

fig.4 Example of WebGIS based database of Tel Ein Gev excavation