Interdisciplinary Knowledge Transfer within Surveying Higher Education

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26 February, 2009

FIG Commission 2 Workshop

Navigating the Future of Surveying Education
26-28 February 2009, Vienna, Austria

i3mainz

Institute for spatial information and surveying technology

scientific organisation of department of geo-information and surveying, university of applied sciences Mainz

- centre of research in German Land Rhineland-Palatinate
- centre of competence for spatial information technology in the field of heritage and arts

i3mainz

founded in 1998

activities

applied research and development and transfer of technology in the field of spatial information and surveying technology

➔ precise collection, processing and visualisation of spatial information of all kinds of spatial objects

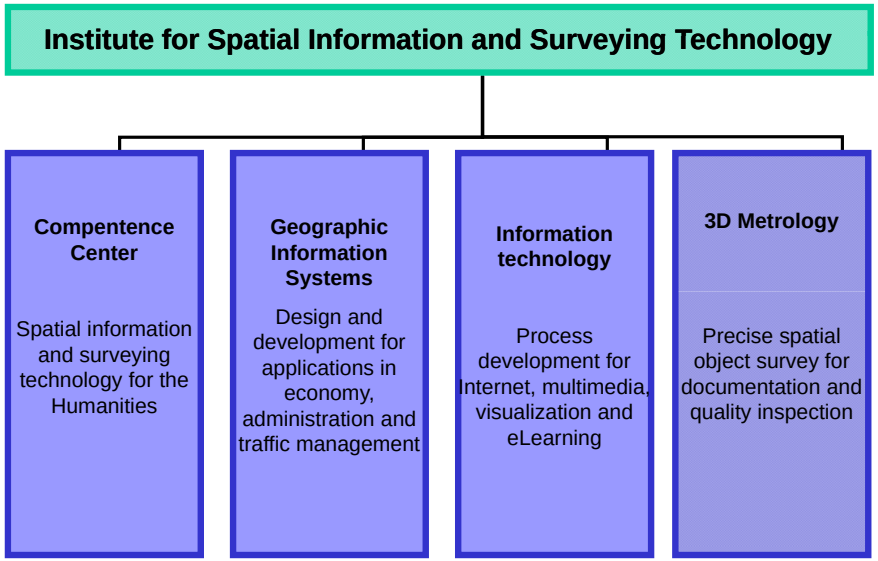
financial base

project financing (2007: 1,3 MEUR)

personal

actual 20 scientific staff members, (3 phd students)

supported / guided by 5 professors



3D industrial metrology @ i3mainz
- Equipment -

3D scanners

FaroArm

Laser interference comparator

Laser tracker

Thedolite measurement system

Precision cameras

3D-Scanning

Terrestrial laser scanner

Leica HDS 6000

Leica HDS 3000

Faro LS 880

- accuracy: 5 mm

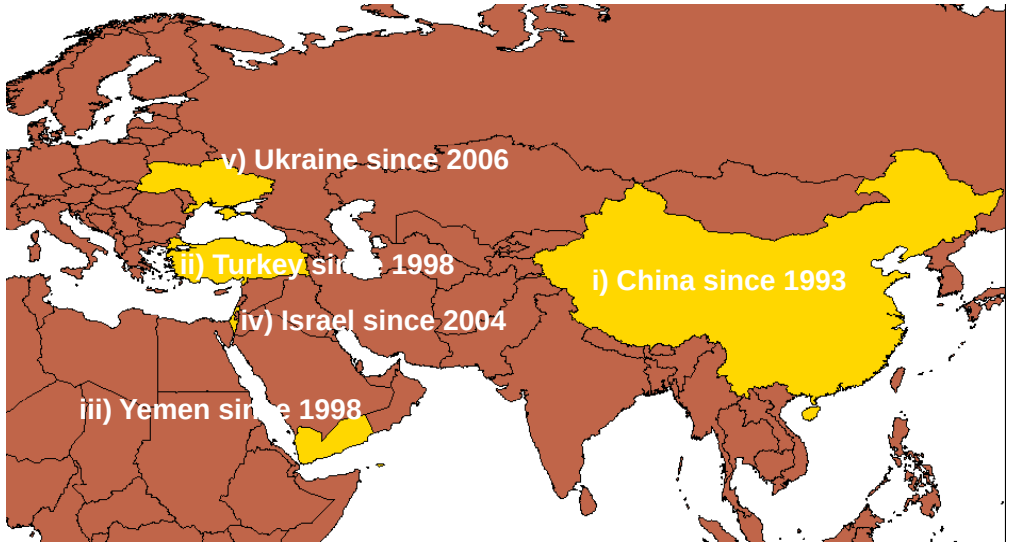
Close range fringe projector

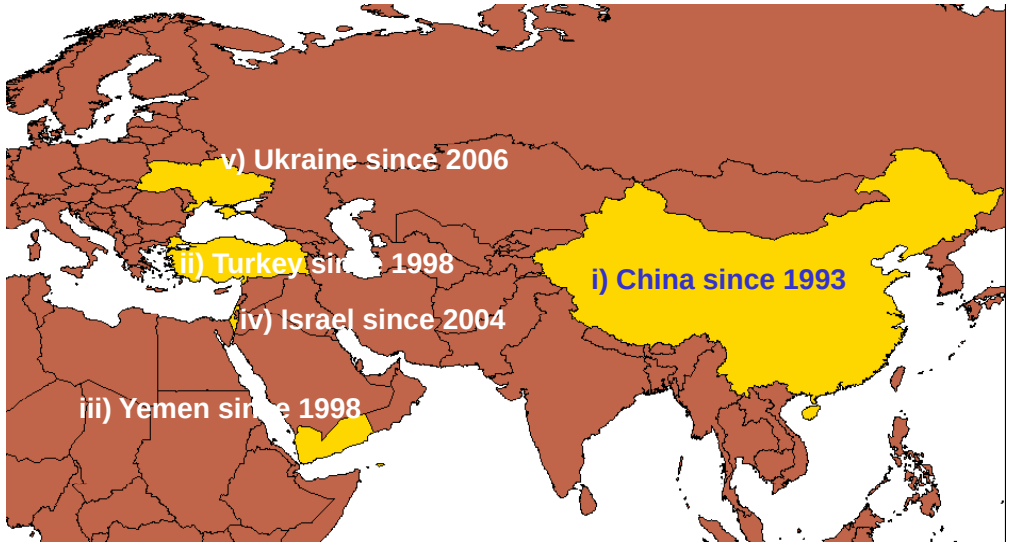
GOM Atos II

- accuracy:
  up zu 0,02 mm

Presentation Overview

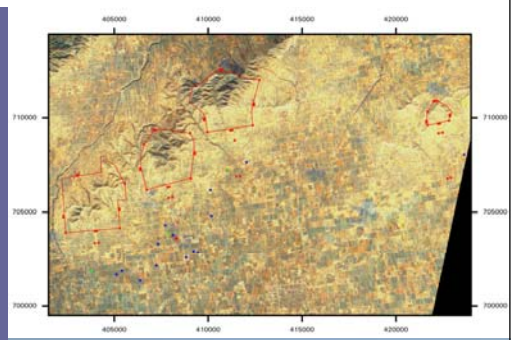
- long-term experience at i3mainz available in co-operation projects with partners from the humanities
- archaeological and cultural heritage documentation
- discussion of about 40 diploma thesis executed outside Germany
- close co-operation with students and professionals of other disciplines
- surveying students gain valuable knowledge from other fields





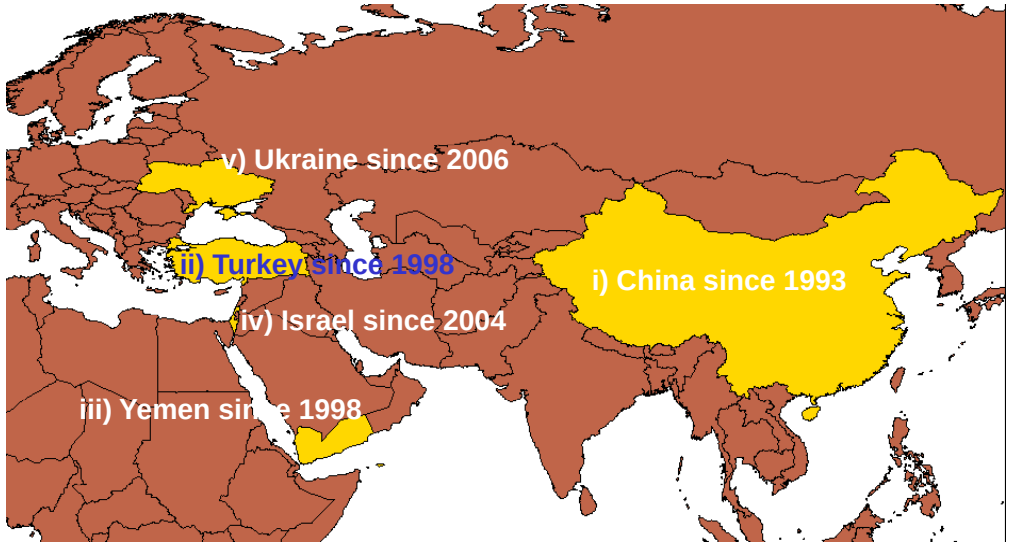
China since 1993

- Shaanxi province, People's Republic of China, location of 18 Mausoleums of Tang Emperors (> 100 km²)
- Internal part of one single mausoleum > 10 km²
- International research project at Roman Germanic Central-Museum in Mainz, Germany, tasks of geometric documentation of sites and findings
- 10 diploma works, field work and home work
- Measurement field work in close cooperation with archaeologists and additional local staff

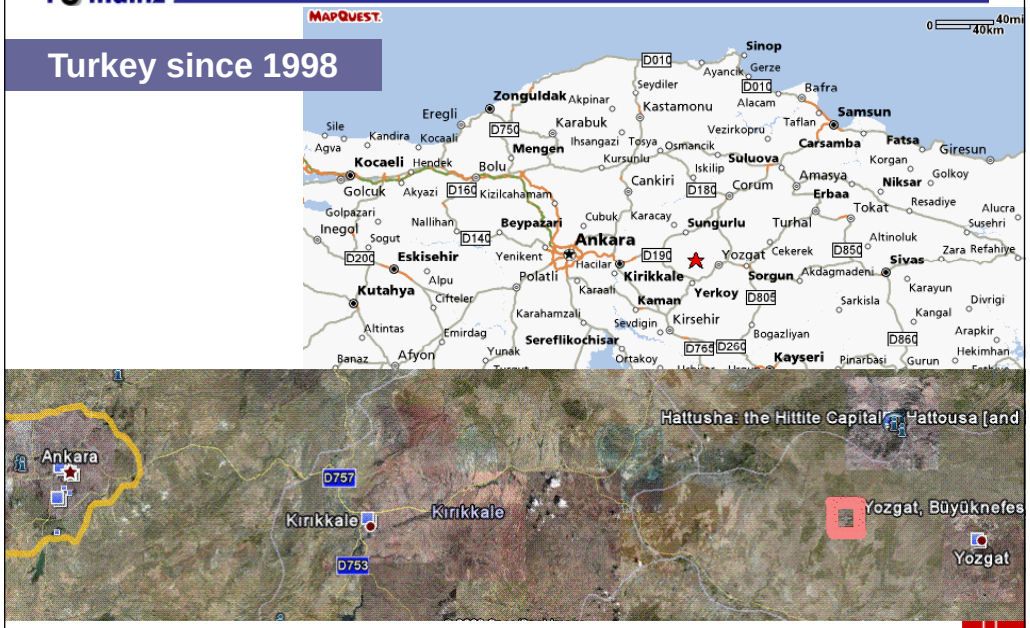


China since 1993

- Official reference frame not accessible → local reference frames, orientation by astronomical azimuths
- Topographic maps generation in various scales for whole mausoleums and for selected parts
- 40 maps in scales from 1/5 up to 1/10000
- Small-scale maps, aerial images not available → satellite images LANDSAT 30m, SPOT 10m
- Large-scale maps → tacheometric measurements, GPS
- More than life-sized sculpturs of humans, animals, mythical creatures at precession ways → terrestrial photogrammetry



Turkey since 1998



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Turkey since 1998

- Ancient Galatian city of Tavium located at present-day village of Büyüknefes, 150 km east of Ankara, 20 km from the Hittite capital of Hattusha
- In 3rd century BC occupied by Celtic tribe Trocmii, flourishing phase in Hittite period
- 150 hectares city area surveyed by a team led by Karl Strobel, University of Klagenfurt, Austria concentrating on extensive Roman and Byzantine remains
- 11 diploma works, field work and home work
- Official reference frame not accessible, no aerial images available, no satellite images available due to very restricted budget
- 1/500 large scale documentation of core area by tacheometric and GPS surveys
- 1/5000 small scale documentation of surroundings by digitizing existing maps

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Turkey since 1998

- 3D digital height model generated from existing maps
- Base for perspective views, virtual flights, cross sections, visibility analysis, slope aspect/ratio analysis

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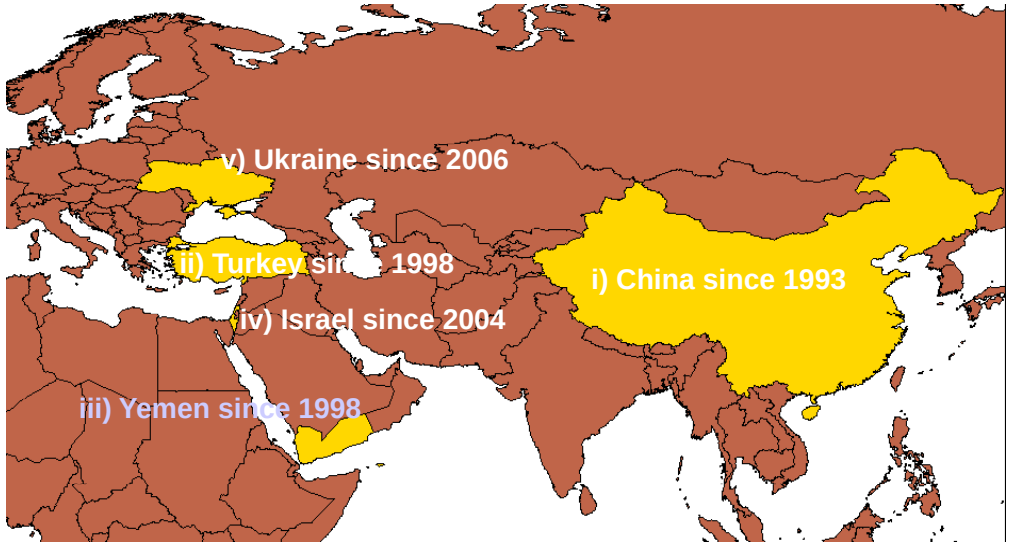
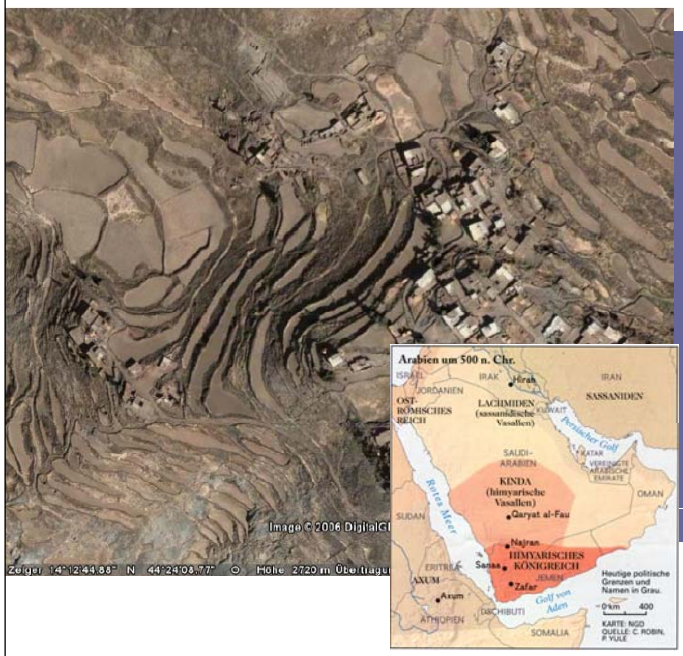


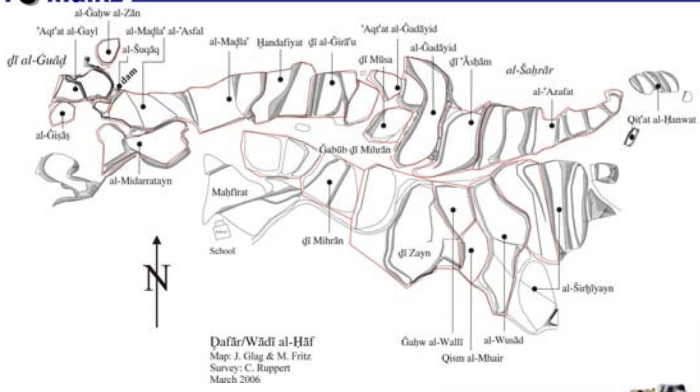


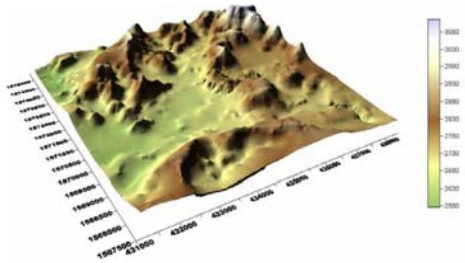
Yemen since 1998

- Ruined city Zafar, location some 130km south-south-west of the Yemenite capital, Sanaa in the mountains at 2800m altitude
- In 6th century AD 110 hectares large Zafar, ancient capital of the Himyar Empire, was one of the most important cities in the Near East

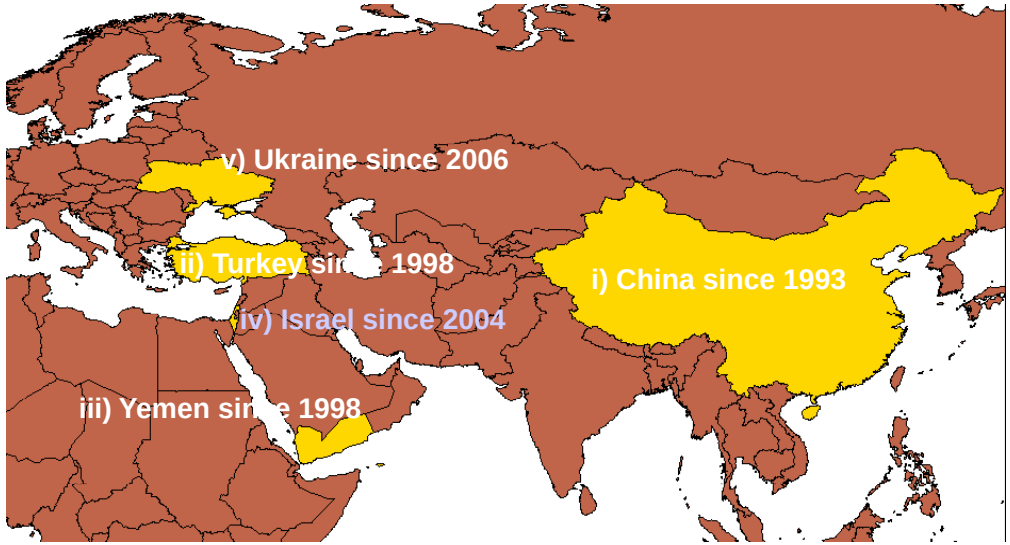
Yemen since 1998

- In 1998, Heidelberg University initiated programme of excavation, mapping and training
- Field campaigns in 1998, 2000, 2002, 2003, 2005, 2006, 2008 with 13 diploma works
- Documentation of the terrain surface and of archaeological findings
- Local reference frame, weak GPS reference frame
- Generation of digital orthophotos, digital height models, virtual three-dimensional reconstructions from satellite images
- Development of a prototype geoinformation system





Yemen since 1998



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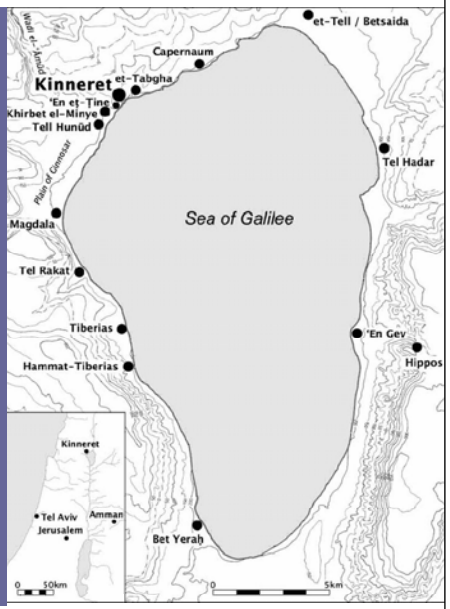
Israel since 2004

- 4 diploma works
- Spatial reference system connected with the official Israel reference system
- Re-survey of the 10.000 m² site of Tel Kinrot
- Development of an optimised workflow, precise and fast differential GPS survey of antemeridian work → noontime processing → updated database for the afternoon work
- Aerial photos from a small hot-air airship, DISTA (digital stereoscopic evaluation architecture) - system developed at i3mainz → build up stereo models and registration of 3D objects (points, lines, poly-lines, polygons)



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kinneretregionalproject

A European Expedition to the Northwestern Shore of the Sea of Galilee

in collaboration with

Stefan Münger (Bern), Dr. Juha Pakkala (Helsinki), Prof. Jürgen Zangenberg (Leiden)
(Co-directors)

Prof. Wolfgang Zwickel (Mainz)
(Project coordinator)

and in collaboration with

Dr. Guy Bar-Oz (paleozoology), Gus Besuijen (survy registrar), Rick Bonnie (area-supervisor), Irina Gutman (restorer), Stefan Höhn (field assistant; landscape archaeology), Virpi Holmqvist (researcher), Dr. Marlies Klee (paleobotanist), Ronja Kratz (graphic artist), Dipl. ing. Daniel Lechner (surveyor), Christa Lennert (graphic artist), Kimi Maman (conservation specialist), Dipl. ing. Bärbel Schönewelß-Mehring (architect), Dipl. ing. Christian Mayer (GIS-specialist), Inga Müller (excavation registrar), Prof. Martti Nissinen (area-supervisor), Dr. Lucas Petit (field director, Horvat Kur/area-supervisor), Meike Range (graphic artist), Katri Saarelainen (area-supervisor), Dr. Juhana Saukkonen (researcher), Kerstin Schier (restorer), Dipl. ing. Natalie Schmidt (surveyor, 3D-modeling), David Steinmann (cartographer), Iris Thomsen (field assistant), Tuula Tynjä (ceramicist), Kirsi Vaikama (co-field director Tel Kinrot/area-supervisor), Mark van den Enden (survey-co-director), Daniella Vos (field-assistant), Patrick Wyssmann (photographer/numismatics).

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kinneretregionalproject

www.kinneret-excavations.org

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Layout, design and concept: S. Münger

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Israel since 2004
Interdisciplinary Staff 2008

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Field work opportunity

Are you interested in participating in the archaeological fieldwork of the Kinneret Regional Project? Browse through these webpages to learn more.

Registration for 2009 soon to be opened

Check back soon or contact us if you have any questions regarding the project.

Welcome to the Kinneret Regional Project website!
The Kinneret Regional Project is a European expedition to the northwestern shore of the Sea of Galilee under the auspices of the Universities of Bern (Switzerland), Helsinki (Finland), Leiden (The Netherlands) and Mainz (Germany). Its research focus is to explore the site of Tel Kinrot – ancient Kinneret – and its environs.

UNIVERSITÄT BERN · UNIVERSITY OF HELSINKI · Universiteit Leiden Faculty of Religious Studies · JOHANNES GUTENBERG UNIVERSITÄT MAINZ

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Kinneret			Tel Hadar	Beth Shean	Hazor	Dan	Megiddo	Jokneam	Tell Kelsan	Tell Qasile
Early Iron Age	VI	Spiral stratigraphy, solid and its parts rebuilt/re-paired arch. *** Main Early Iron Age Horizon	–	VI (S-3a-b)?	–	(V)	VIB	XVII	9c	XI
	V		IV	(Late) VI / V (Temples) = S-2	XI/XI	IVB	VIA	XVI	9b-b	X
		Destruction by earthquake	probably	probably	?	yes	yes	probably	probably	yes
	IVC1-2	Part. Reuse of Str. V + extension of architecture	–	–	–	–	–	XVI	–	–
	IVB1-2	New Layout, solid architecture	–	–	–	–	–		–	–
	IVA-1	Squatter habitation, poorly built	–	(Lower V) + Rehov VI	–	IVA(?)	VB		8c	IX

kinneretregionalproject Extended Stratigraphy According to Area

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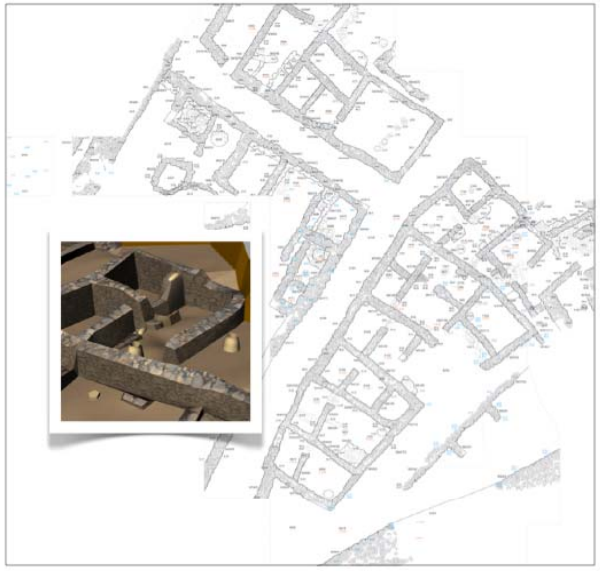

kinneretregionalproject Reassessing the Stratigraphy and Architecture in «Field I»

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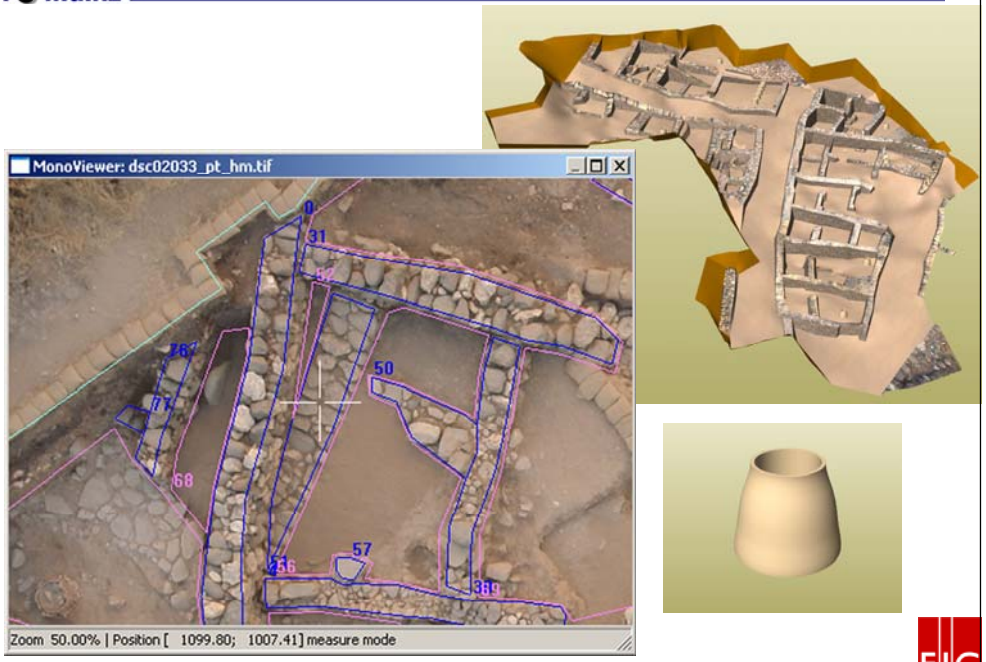

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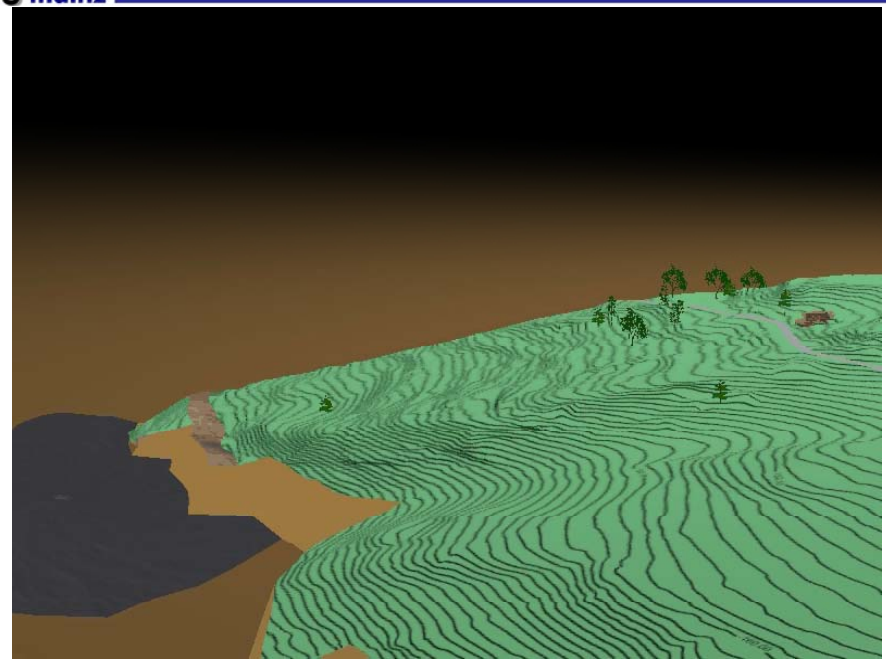

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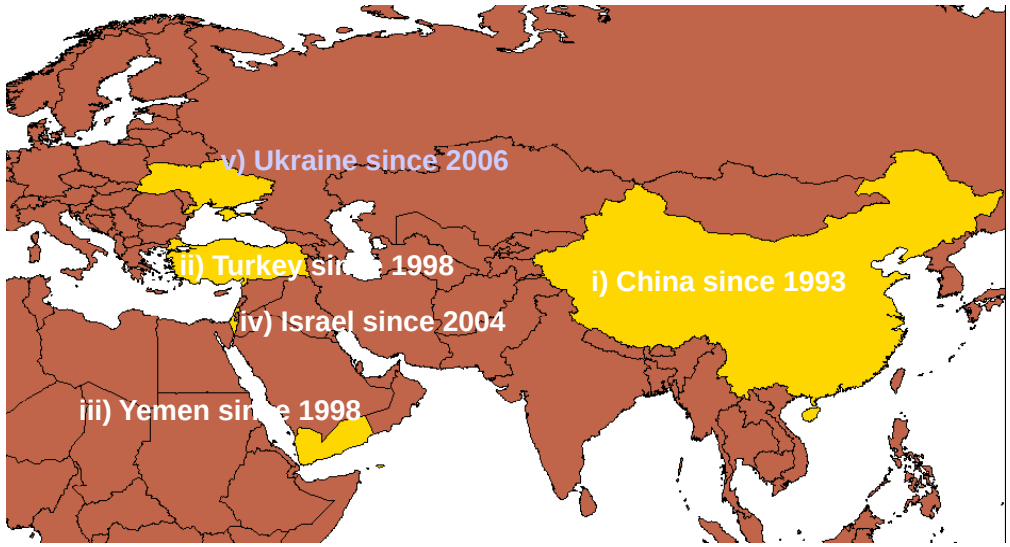

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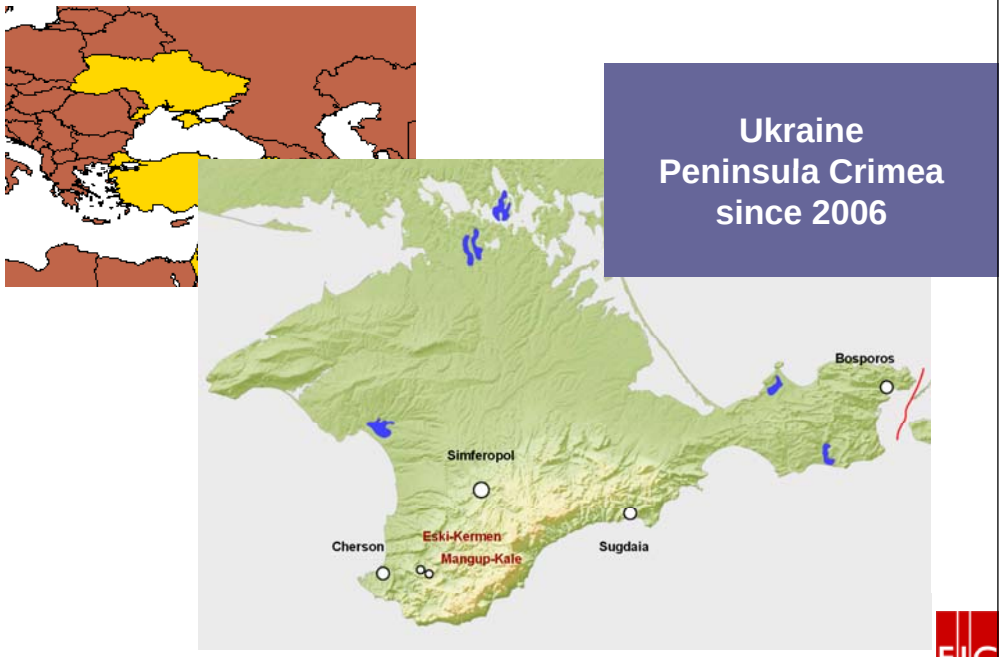

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Ukraine since 2006

- Settlement history starting from 6th century AD of two hill settlements, Eski-Kermen and Mangup-Kale
- 3D-documentation of landscape and of more than 600 artificial caves
- Cooperation of Mainz University of Applied Sciences and Roman-Germanic Central Museum, Mainz
- 3 diploma thesis, 1 master thesis
- Establishment of a common reference system for all findings → long-range >50 km GPS application
- Efficient use of methods for geometric documentation in archaeology → use of GPS, total station, close range photogrammetry, 3D-laserscanning
- Integration of old maps with modern data by using old landscape marks
- GIS for storage, administration and analysis of all project data, collection of attribute data in close cooperation of German and Ukrainian archaeologists
- Generating maps in various scales, visualization and reconstruction tasks

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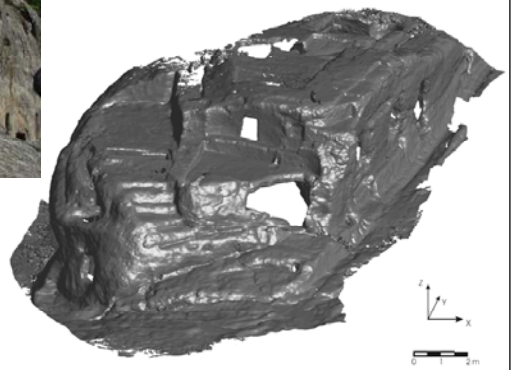
Eski-Kermen, Southern main gate
view from south



Eski-Kermen, 3D laser-scanning
Southern main gate

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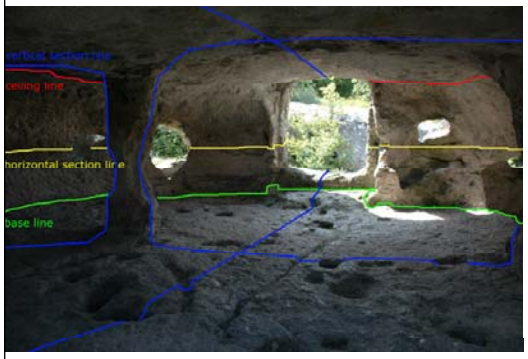
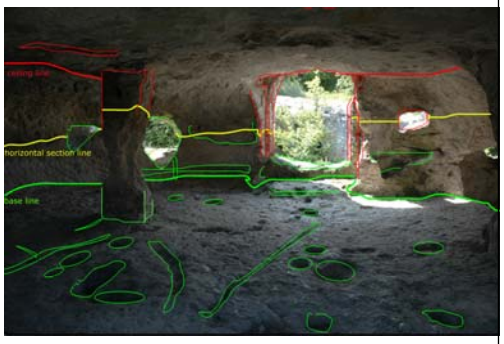


Main measures of the interior of a cave



measurement of carved objects in a cave considering the position under (green) or above (red) the section line

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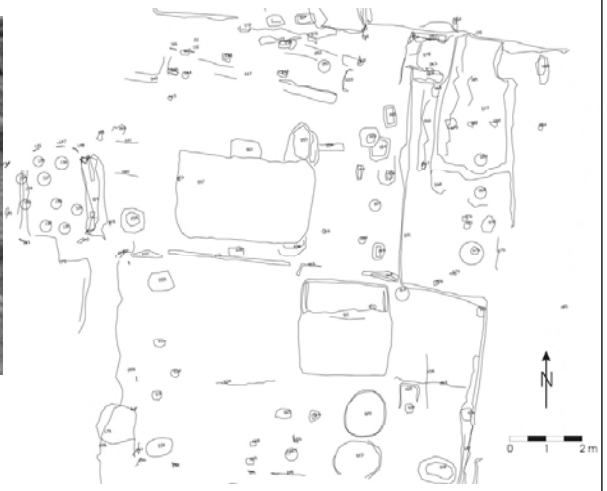

Eski-Kermen
Exterior area with a great rectangular cutting and negative traces of buildings
recorded data from total station measurements
view from south

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Conclusions

- Integrated approach of research co-operation and higher education
- Substantial benefit for students from close research co-operation of spatial information and surveying specialists with partners from the humanities, arts, etc.
- Valuable personal and professional experience for students gained from remote field work within an interdisciplinary team
- Development of new interdisciplinary professional fields
- Development of integrated interdisciplinary study courses with partners of different scientific background from different higher education institutions

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Future work

- Development of an integrated curriculum for archaeologists and spatial information technology engineers
- Entrance qualification

BA in Archaeology or similar (Mainz University or others)

BA in Geoinf&Surveying or similar (Mainz Univ of Appl Sciences or others)

- One semester

knowledge adaptation

knowledge adaptation

separate education

- Three semesters

Interdisciplinary applications of Spatial Information and Surveying Technology

collective education

- Award of joint MA master degree

MA in ???