Out of Africa – Late Pleistocene Rock Shelter Stratigraphies and Palaeoenvironments in Northeastern Africa
Data Management and Data Services
CRC 806 - Our Way to Europe

PaleoMaps: GIS based Palaeoenvironmental data collection for the Last Interglacial (125 ka) of Egypt

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Introduction

The growing number of paleoenvironmental data, GIS-based analyses and modelling allows us to produce PaleoMaps for a given area. However, the „translation" of paleoenvironmental information in maps is even more complex, than producing maps as an illustration of the present.

Concept and Workflow

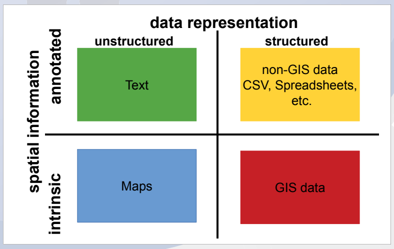
1. Recent mapping of natural environments
2. Identification of influencing processes and changes
3. Transfer of variables
4. Modified landscape units/ PaleoMap for distinct timeslices

The CRC 806 "Our Way to Europe" provides the background to study the culture-environment interaction and human mobility in the Late Quaternary. Northeastern Africa during the Last Interglacial is thereby an important region and timespan. From this point, a first conceptual design for a PaleoMap of Egypt for the time about 125 ka ago is presented.

PaleoMaps

GIS based paleoenvironmental data is comparatively rarely published in the scientific record.
The open science approach is allowing the access for the valorization of paleoenvironmental.

Different data sources in various formats and representations are used for the integration of paleoenvironmental data into PaleoMaps (Willmes et al. 2016a).



Most commonly, scholarly articles verbally describe paleoenvironmental conditions in certain spatial and temporal contexts. Furthermore, much of paleoenvironmental data is given in structured non-spatial formats (spreadsheets or relational data bases). Published Maps are often a composite of research.

More information:
http://crc806db.uni-koeln.de/services/paleomaps/
http://crc806db.uni-koeln.de/about/open-science/

OPEN SCIENCE

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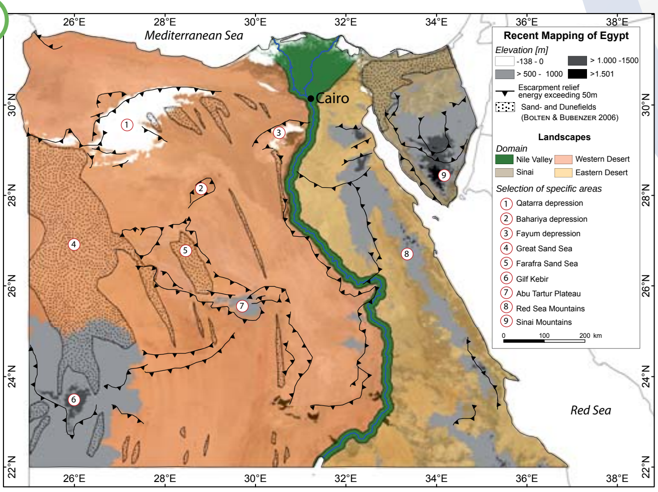

Criteria for distinguishing different landscapes are for instance active dune areas (Great Sand Sea, Farafra Sand Sea), mountainous regions (Sinai, Eastern Desert), escarpments and plateaus (Abu Tartur Plateau) or the ecology (Nile Valley), where substantiall changes took place since the last interglacial.

The "status quo" of the recent landscape setting serves as base for the transfer into a PaleoMap:

Questions / Challenges:

- Which characteristics are variable throughout time, which are constant?
- What are the main characteristics of the landscape domains?
- How has a given landscape changed under different environmental setting?

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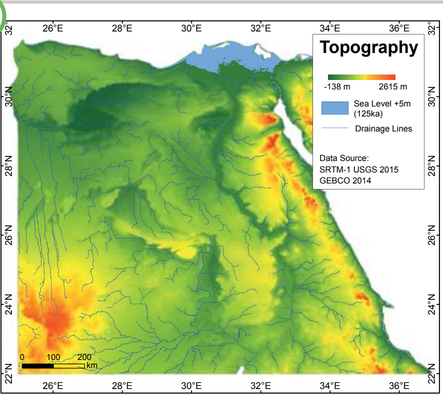
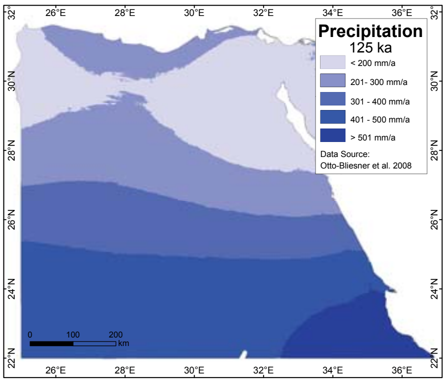
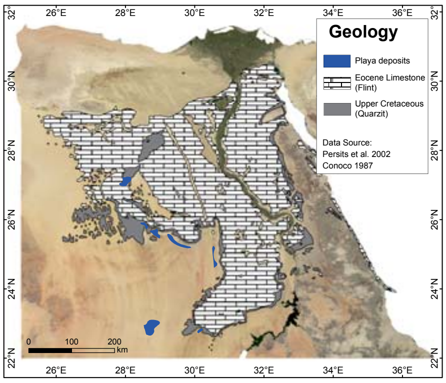






Various data sets are independently compiled and their influence on different scales on the given landscapes have to be investigated. The maps show different GIS-data, and the specific variables serve as parameters for the correlation and calculation of continuative features for the representation of the paleoenvironment. This collection is going to be continuously expanded.

3 Example for transfer of variables

Climate models only supply single output variables, e.g. precipitation or temperature. Combining these parameters to climate classifications helps for a better understanding of the paleoenvironment.

Willmes et al. (2016b) developed an algorithm to compute Köppen-Geiger classification of paleoclimate simulations.

External climate data and input parameters derived from global climate models

Input parameters

- Mean Annual Precipitation P_{ann}
- Driest Month P_{dry}
- Wettest Month P_{wet}
- Mean Annual Temperature T_{ann}
- Coldest Month T_{cold}
- Hottest Month T_{hot}

Example of Köppen-Geiger-Classification for arid environments. Adaptations can be implemented within the published source code.

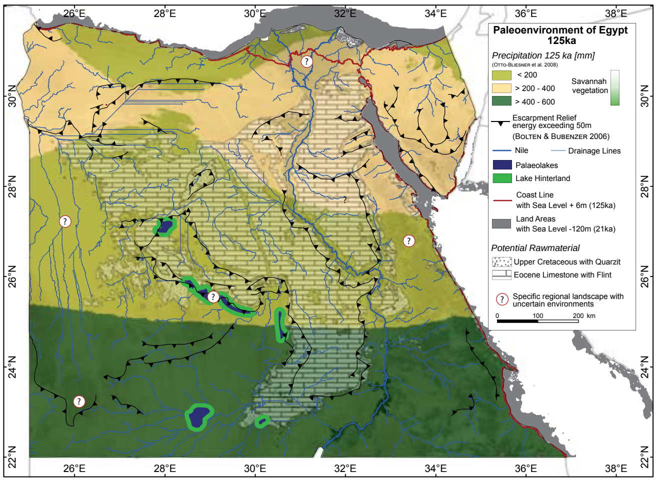
pyGRASS script is online available:

http://dx.doi.org/10.5880/SFB806.1

Computation of Köppen-Geiger-Classification using pyGRASS script

1st	2nd	3rd	Description	Criteria
B			Arid	$P_{ann} < 10 \times P_{threshold}$
	W		-Desert	$P_{ann} < 5 \times P_{threshold}$
	S		-Steppe	$P_{ann} \geq 5 \times P_{threshold}$
		h	-Hot	$T_{ann} \geq 18_{ann}$
		k	-Cold	$T_{ann} < 18_{ann}$

after Peel et al. (2007) based on Kottek et al. (2006)



4 Results & Conclusion

The map is displaying a first collection of data for the last interglacial of Egypt, showing the general pattern of more humid conditions.

Formation of a savannah ecozone is likely in most parts. Activation of the drainage system as well as lake formations have been proofed from the literature.

Feedback mechanism of changed parameters to various landscapes are often still questionable and sedimentological / archaeological records about the palaeoenvironment have to be integrated.

However, the produced datasets and maps serve as background for modelling human behavior, e.g. by Agent-Based-Modelling, and is a future prospect of the PaleoMaps project.

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Acknowledgment

DFG

The German Research Foundation is founding this project as part of the CRC 806 "Our Way to Europe". www.sfb806.uni-koeln.de/

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