



HEIDELBERGER AKADEMIE
DER WISSENSCHAFTEN

ERHARD KARES
UNIVERSITÄT
TÜBINGEN

SENCKENBERG
world of biodiversity

AG Computeranwendungen und Quantitative Methoden in der Archäologie
5. Workshop Tübingen
14. – 15. Februar 2014



Browser-gestützte Visualisierung komplexer Datensätze: Das ROAD System

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ROAD

The ROCEEH Out of Africa Database

Aims of ROAD

- Creating a spatial and relational database for:
 - Archaeological, Palaeoecological, -ontological, -anthropological data
 - Physical-geographic data
 - Remote Sensing data
- Presenting information in an easy accessible/intuitive way
- Storing meta data
- Spatial and temporal archeological queries not yet been considered
- Data mining

ROAD

ROCEEH – Out of Africa Database



What do we need to answer our research questions?

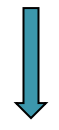
ROCEEH Data & Analysis Requirements:

- storage and backup of data
 - easy data exchange
 - visualization of geodata
 - simple GIS functions
 - query geodata and project relevant information
(Palaeontology, Archaeology, Paleo-Climatology, etc.)
 - easy to use
 - web access
 - not only DB.....but:
- **Analysis tool for spatio-temporal expansion pattern**
>>>>ROAD ROCEEH Out of Africa Data base<<<<

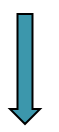


ROCEEH database model and GIS-interface

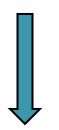
Database model



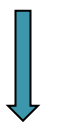
PostgreSQL



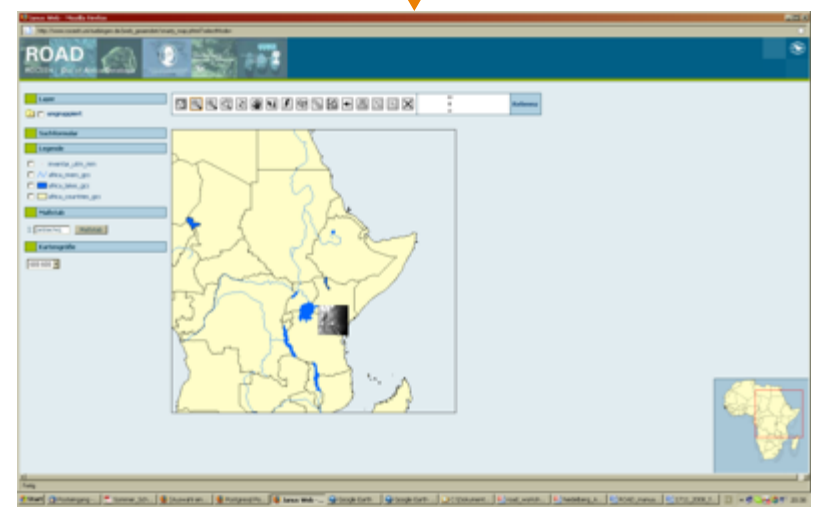
PostGIS



UMN Mapserver



DB-System Prototype



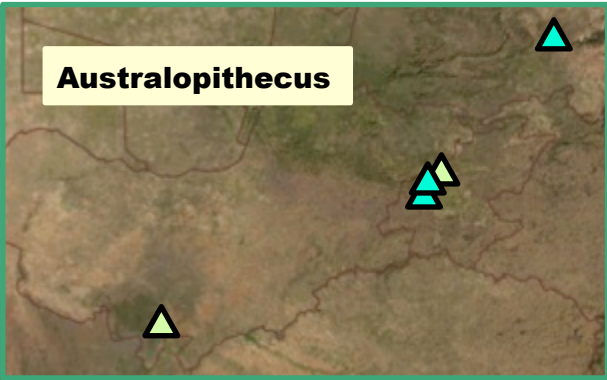
Aims



Queries

Localities with human remains dated 50 to 150 ka.

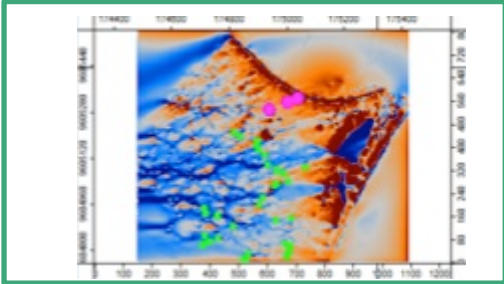
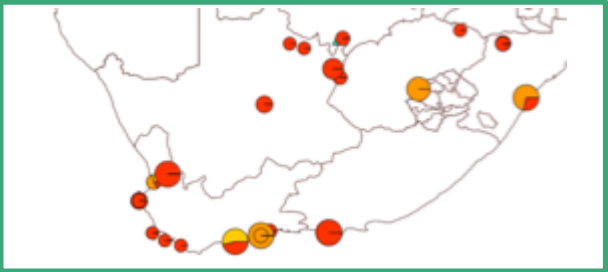
Visualization



Data storage

ROAD

Statistical Analysis



GIS Applications



ROAD

Visualizations

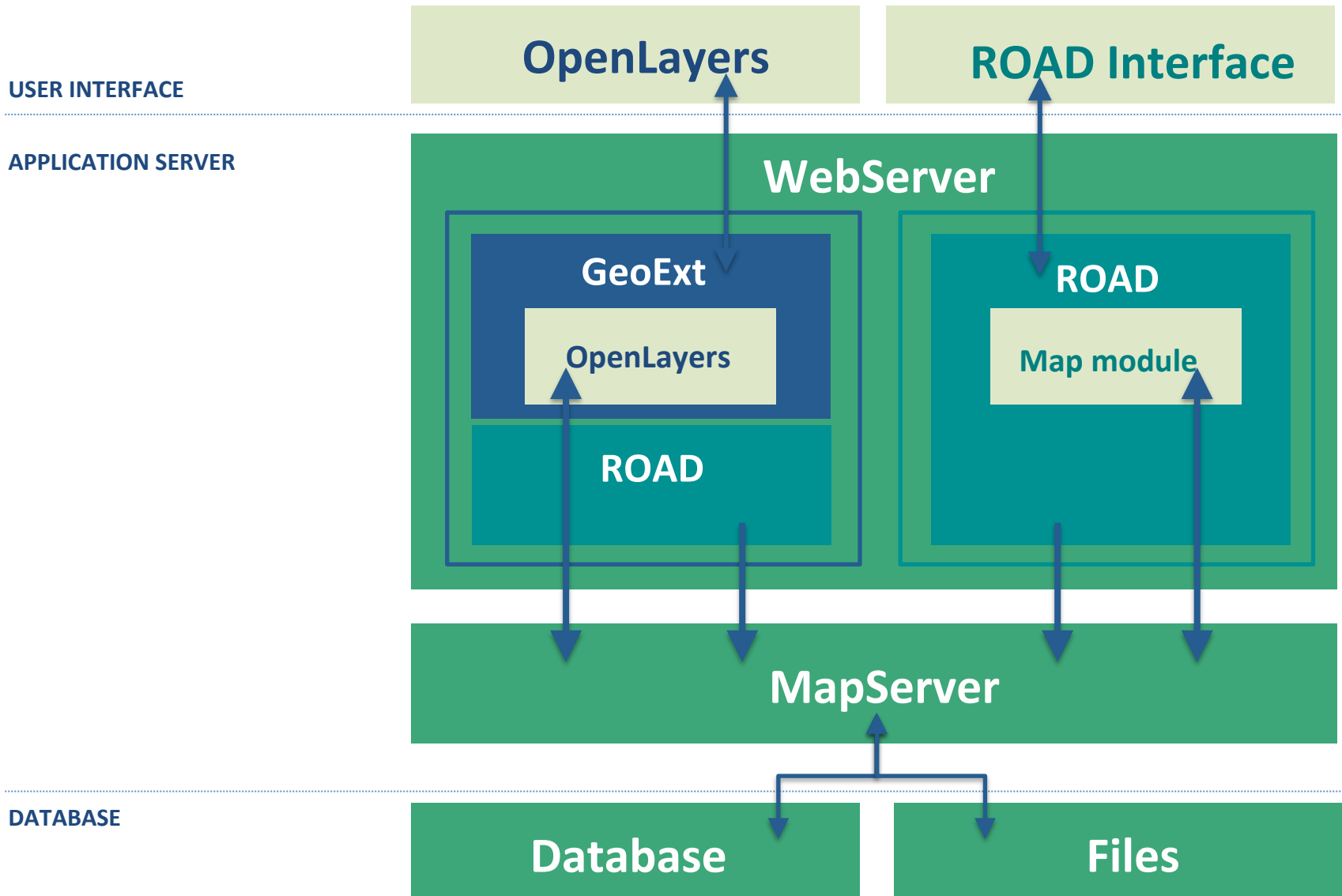
1st Level – **PUBLIC** Results

2nd Level – **INTERN + ASSOCIATED MEMBERS** Analysis

3rd Level – **INTERN** higher abstracted data

4th Level – **INTERN** public data (Literature, ...); own data (field work, satellite data)

Infrastructure



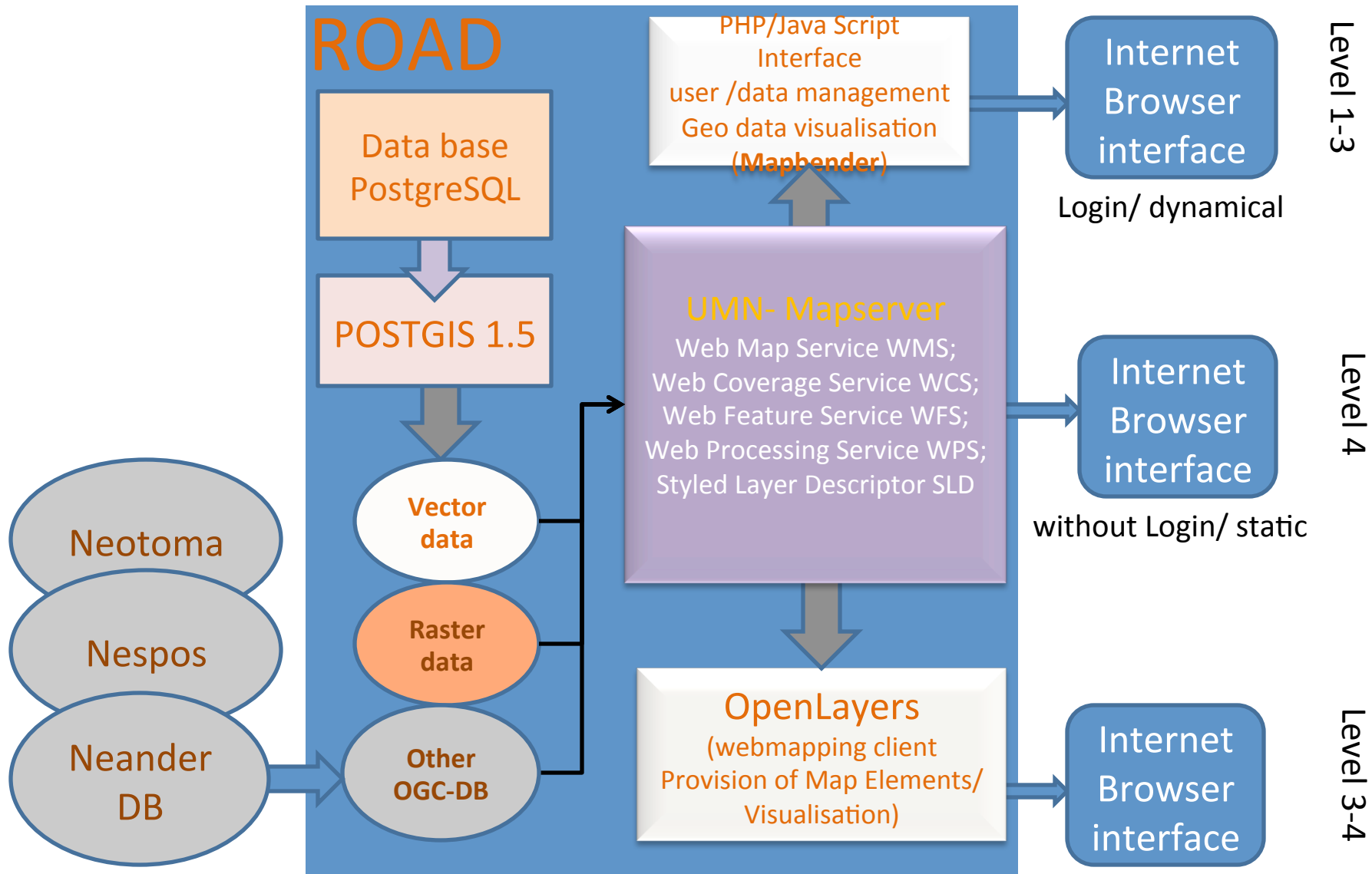
ROAD

ROCEEH – Out of Africa Database

Data types

ROAD Services

Visualisation



ROAD

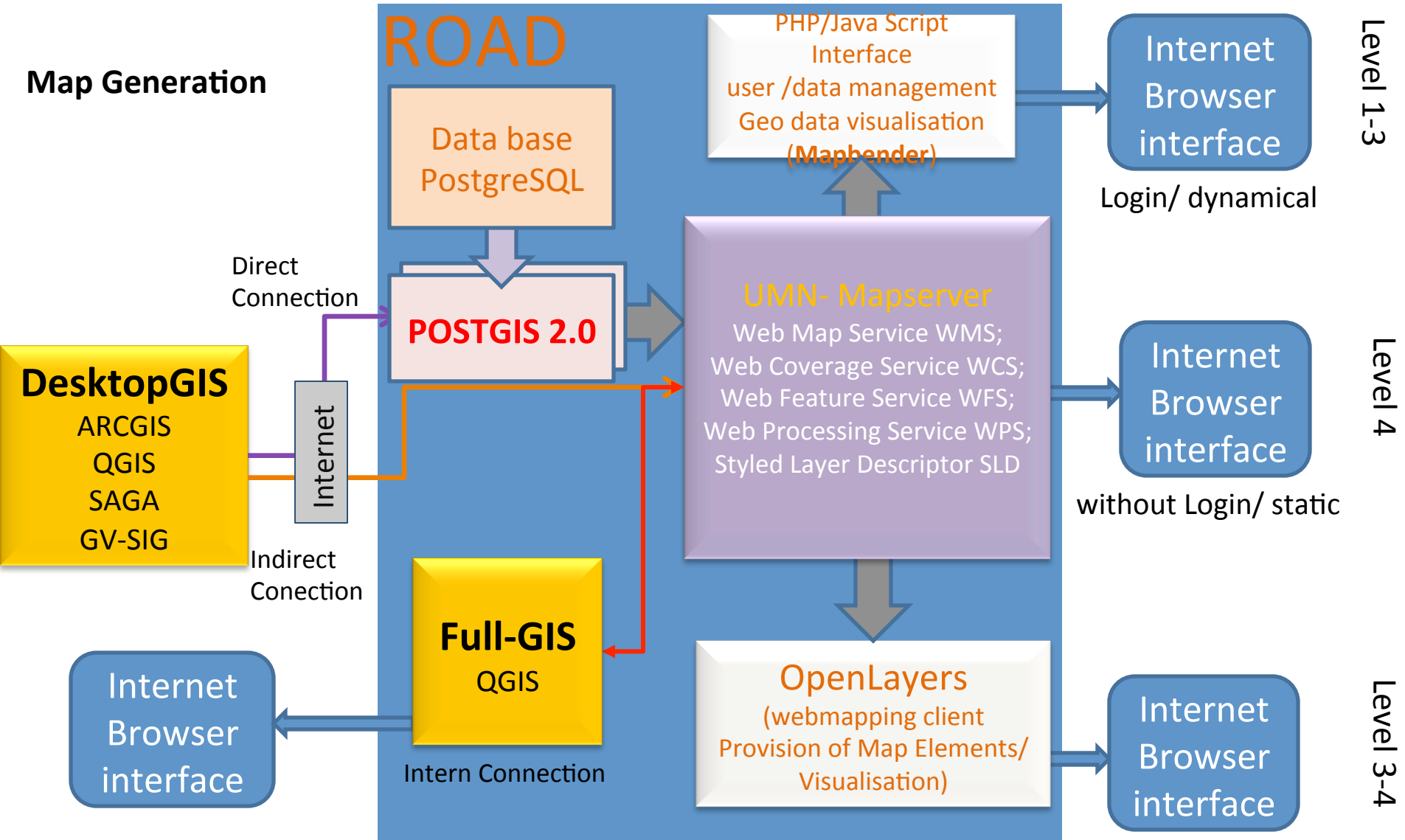
ROCEEH – Out of Africa Database

Data types

ROAD Services

Visualisation

Map Generation





From Requirements to Functioning System.....

⇒ Functioning ROAD-System

.....but something is missing.....

⇒ Data input..... how to get data in ?



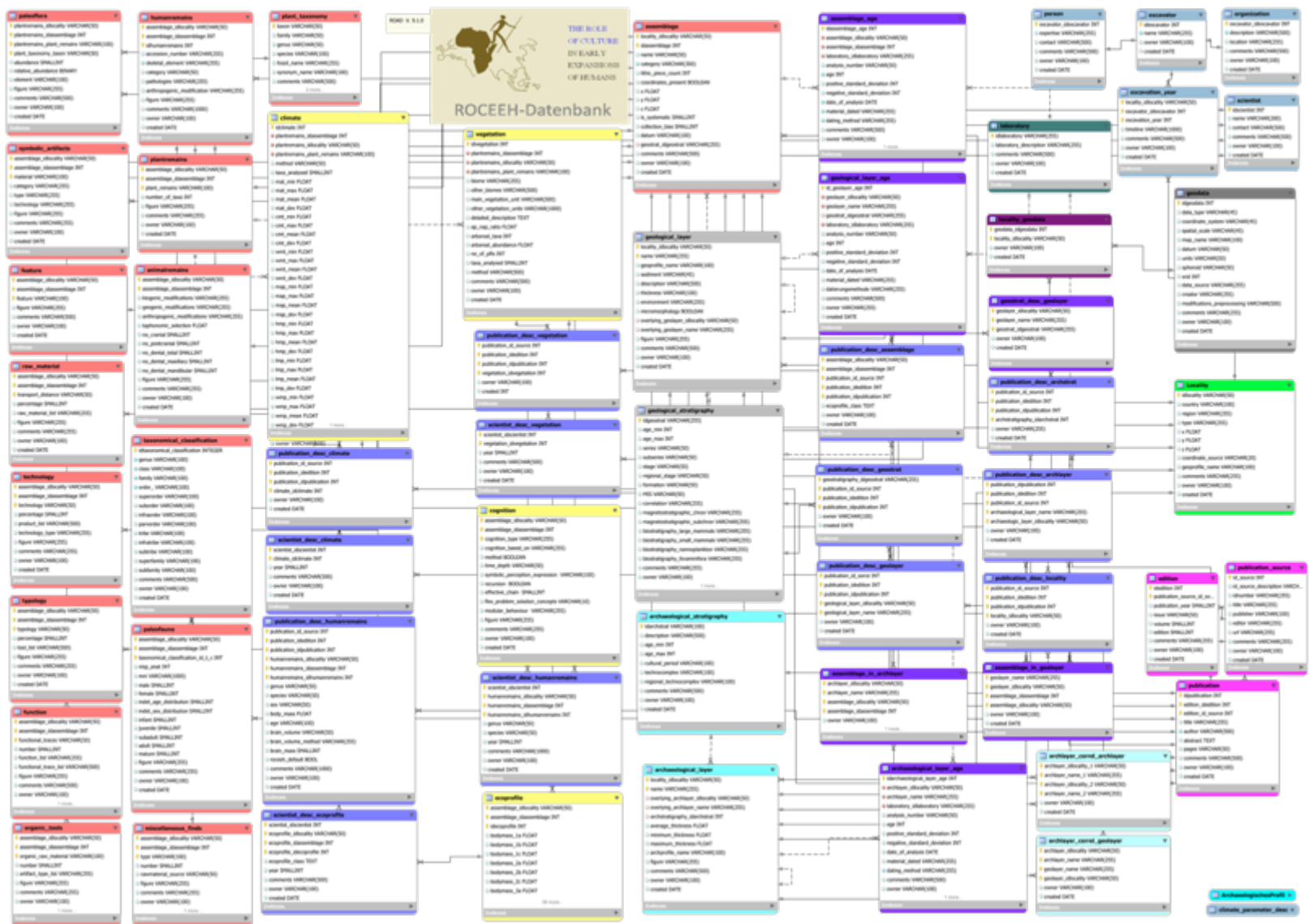
Data sources

- and **You!!!**

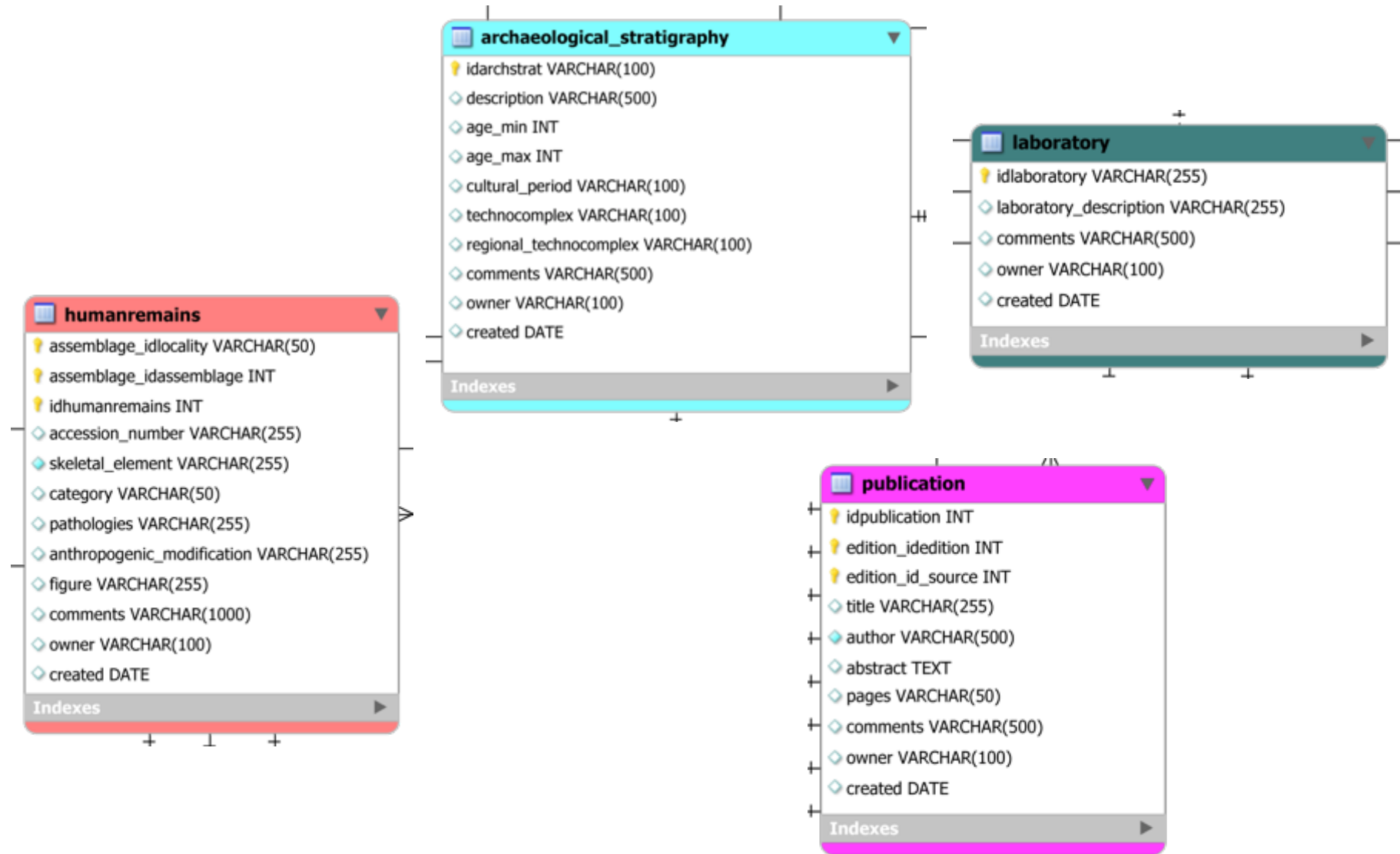
- Available data on the web
- Research networks & partnerships
- Surveys, excavations, field sampling
- Examination of museum collections
- Published literature



ER- Model



ER- Model





1 What do I want?

I want to get a list as well as a map of all hominins between 1.6 and 2 Ma.

2 What tables do I have to query in order to get these results?

- Age: geological_stratigraphy
- Hominins: publication_desc_humanremains
- Location: locality

Queries



geological_stratigraphy	
idgeostrat	VARCHAR(255)
age_min	INT
age_max	INT
series	VARCHAR(50)
subseries	VARCHAR(50)
stage	VARCHAR(50)
regional_stage	VARCHAR(50)
formation	VARCHAR(50)
MIS	VARCHAR(50)
correlation	VARCHAR(255)
magnetostratigraphic_chron	VARCHAR(255)
magnetostratigraphic_subchron	VARCHAR(255)
biostratigraphy_large_mammals	VARCHAR(255)

Locality	
idlocality	VARCHAR(50)
country	VARCHAR(100)
region	VARCHAR(255)
type	VARCHAR(255)
x	FLOAT
y	FLOAT
z	FLOAT
coordinate_source	VARCHAR(20)
geoprofile_name	VARCHAR(100)
comments	VARCHAR(255)
owner	VARCHAR(100)
created	DATE

Indexes

Must contain information!

publication_desc_humanremains	
publication_id_source	INT
publication_idedition	INT
publication_idpublication	INT
humanremains_idlocality	VARCHAR(50)
humanremains_idassemblage	INT
humanremains_idhumanremains	INT
genus	VARCHAR(50)
species	VARCHAR(50)
sex	VARCHAR(50)
body_mass	FLOAT
age	VARCHAR(100)
brain_volume	VARCHAR(50)
brain_volume_method	VARCHAR(255)
brain_mass	SMALLINT
roceeh_default	BOOL
comments	VARCHAR(1000)
owner	VARCHAR(100)
created	DATE

Indexes

Queries



Tables included in the query

- function
- geodata
- geological_layer
- geological_layer_age
- geological_stratigraphy
- geopolitical_units
- geostrat_desc_geolayer
- humanremains
- laboratory
- locality**

Criteria for the query

publication_desc_humanremains.humanremains_idlocality = locality.idlocality () clear

and clear

publication_desc_humanremains.genus is NOT NULL () clear

and clear

publication_desc_humanremains.species is NOT NULL () clear

Criteria for the query: publication_desc_humanremains.humanremains_idlocality = locality.idlocality and publication_desc_humanremains.genus is NOT NULL and publication_desc_humanremains.species is NOT NULL

enter value or and/or operator enter subquery or and/or operator

locality				publication_desc_humanremains			
Show	Attribute	Type	Sort by	Show	Attribute	Type	Sort by
<input checked="" type="checkbox"/>	locality.idlocality	varchar	<input checked="" type="checkbox"/>	<input type="checkbox"/>	publication_desc_humanremains.humanremains_idassemblage	int4	<input type="checkbox"/>
<input checked="" type="checkbox"/>	locality.region	varchar	<input type="checkbox"/>	<input type="checkbox"/>	publication_desc_humanremains.humanremains_idlocality	varchar	<input type="checkbox"/>
<input checked="" type="checkbox"/>	locality.country	varchar	<input type="checkbox"/>	<input type="checkbox"/>	publication_desc_humanremains.publication_idpublication	int4	<input type="checkbox"/>
<input type="checkbox"/>	locality.type	varchar	<input type="checkbox"/>	<input type="checkbox"/>	publication_desc_humanremains.publication_idedition	int4	<input type="checkbox"/>
<input checked="" type="checkbox"/>	locality.x	float8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	publication_desc_humanremains.genus	varchar	<input type="checkbox"/>
<input checked="" type="checkbox"/>	locality.y	float8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	publication_desc_humanremains.species	varchar	<input type="checkbox"/>
<input type="checkbox"/>	locality.z	float8	<input type="checkbox"/>	<input type="checkbox"/>	publication_desc_humanremains.sex	varchar	<input type="checkbox"/>
<input type="checkbox"/>	locality.geoprofile_name	varchar	<input type="checkbox"/>	<input type="checkbox"/>	publication_desc_humanremains.brain_volume_method	varchar	<input type="checkbox"/>
<input type="checkbox"/>	locality.comments	varchar	<input type="checkbox"/>	<input type="checkbox"/>	publication_desc_humanremains.publication_id_source	int4	<input type="checkbox"/>
<input type="checkbox"/>	locality.gid	int4	<input type="checkbox"/>	<input type="checkbox"/>	publication_desc_humanremains.humanremains_idhumanremains	int4	<input type="checkbox"/>
<input type="checkbox"/>	locality.created	date	<input type="checkbox"/>	<input type="checkbox"/>	publication_desc_humanremains.age	varchar	<input type="checkbox"/>
<input type="checkbox"/>	locality.owner	varchar	<input type="checkbox"/>	<input type="checkbox"/>	publication_desc_humanremains.brain_volume	varchar	<input type="checkbox"/>
<input type="checkbox"/>	locality.coordinate_source	varchar	<input type="checkbox"/>	<input type="checkbox"/>	publication_desc_humanremains.brain_mass	int2	<input type="checkbox"/>
				<input type="checkbox"/>	publication_desc_humanremains.comments	varchar	<input type="checkbox"/>
				<input type="checkbox"/>	publication_desc_humanremains.owner	varchar	<input type="checkbox"/>
				<input type="checkbox"/>	publication_desc_humanremains.created	date	<input type="checkbox"/>
				<input type="checkbox"/>	publication_desc_humanremains.body_mass	float8	<input type="checkbox"/>
				<input type="checkbox"/>	publication_desc_humanremains.roceeh_default	bool	<input type="checkbox"/>

Age (enter age in years or choose period)

1600000
min Choose period
2000000
max

emains.species is NOT NULL

start search save Save as hominiden_taxon_age

Queries



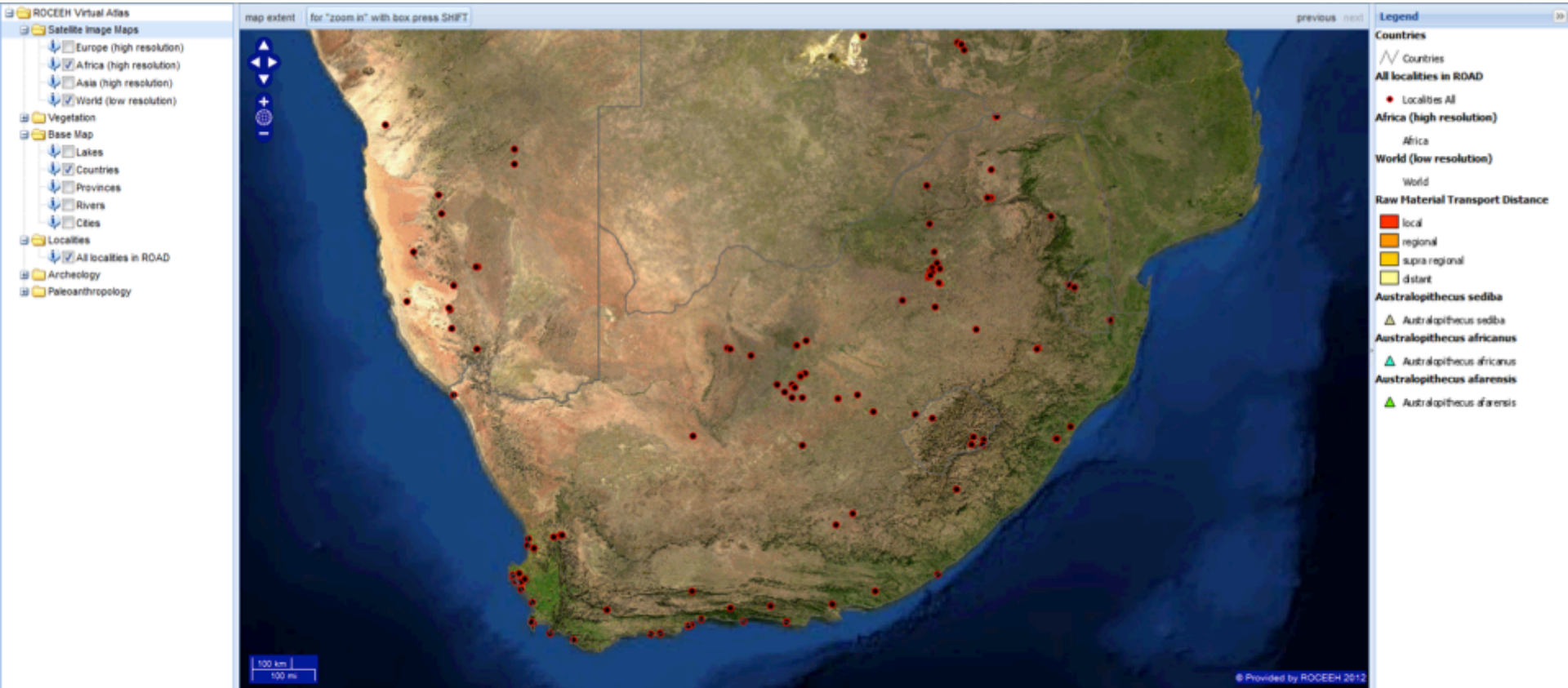
```

result of query
SELECT DISTINCT on (locality.idlocality, locality.region, locality.country, locality.x, locality.y, publication_desc_humanremains.genus, publication_desc_humanremains.species, query_age_min, query_age_max, info_source) locality.idlocality,
locality.region, locality.country, locality.x, locality.y, publication_desc_humanremains.genus, publication_desc_humanremains.species, query_age_min, query_age_max, info_source FROM locality,
publication_desc_humanremains,all_age(1600000,2000000) as (locality varchar,assemblage int, assemblage_name varchar,query_age_min int, query_age_max int, info_source varchar) WHERE
((publication_desc_humanremains.humanremains_idlocality = locality.idlocality and publication_desc_humanremains.genus is NOT NULL and publication_desc_humanremains.species is NOT NULL) and locality =
publication_desc_humanremains.humanremains_idlocality and assemblage = publication_desc_humanremains.humanremains_idassemblage) ORDER BY locality.idlocality (#: 84)
    
```

locality.idlocality	locality.region	locality.country	locality.x	locality.y	publication_desc_humanremains.genus	publication_desc_humanremains.species	query_age_min	query_age_max	info_source
Drimolen	Gauteng	South Africa	27.75583333	-25.96888889	Homo	?	1500000	2000000	Age from Geological Stratigraphy
Drimolen	Gauteng	South Africa	27.75583333	-25.96888889	Paranthropus	robustus	1500000	2000000	Age from Geological Stratigraphy
Gona BSN49		Ethiopia			Homo	erectus	1627000	2720000	Age from Geological Stratigraphy
Kanjera North	Nyanza	Kenya	34.53661389	-0.332552778	Homo	sapiens	990000	1770000	Age from Geological Stratigraphy
Kokselei	Rift Valley	Kenya	35.77166667	3.965	Australopithecus	boisei	1300000	1890000	Age from Geological Stratigraphy
Koobi Fora Area 1	Eastern Province	Kenya	36.27466667	4.316666667	Homo	erectus	1585000	2060000	Age from Geological Stratigraphy
Koobi Fora Area 10	Eastern Province	Kenya	36.31666667	4.3	Australopithecus	boisei	1585000	2060000	Age from Geological Stratigraphy
Koobi Fora Area 10	Eastern Province	Kenya	36.31666667	4.3	Australopithecus	robustus	1585000	2060000	Age from Geological Stratigraphy
Koobi Fora Area 10	Eastern Province	Kenya	36.31666667	4.3	Paranthropus	boisei	1585000	2060000	Age from Geological Stratigraphy
Koobi Fora Area 102	Eastern Province	Kenya	36.33333333	4.083					
Koobi Fora Area 105	Eastern Province	Kenya	36.38083333	4.053					
Koobi Fora Area 105	Eastern Province	Kenya	36.38083333	4.053					
Koobi Fora Area 105	Eastern Province	Kenya	36.38083333	4.053					
Koobi Fora Area 105	Eastern Province	Kenya	36.38083333	4.053					
Koobi Fora Area 116	Eastern Province	Kenya	36.33333333	4.083					
Koobi Fora Area 117	Eastern Province	Kenya	36.33333333	4.083					
Koobi Fora Area 12	Eastern Province	Kenya	36.3	4.266					
Koobi Fora Area 12	Eastern Province	Kenya	36.3	4.266					
Koobi Fora Area 123	Eastern Province	Kenya	36.33333333	4.083					
Koobi Fora Area 123	Eastern Province	Kenya	36.33333333	4.083					
Koobi Fora Area 129	Eastern Province	Kenya	36.33333333	4.083					



Visualization



Title	Layer Description
Countries	Contains countries. Shown as borders in grey color. Source is [NaturaEarth 2009].
All localities in ROAD	All localities in the ROCEEH-database are shown as red dot.
Africa (high resolution)	Satellite image [NASA/MODIS 2001]. This satellite image covers Africa with higher resolution than the satellite image of the world.
World (low resolution)	Satellite image [NASA/MODIS 2006-10]. This layer covers the whole earth but with lower resolution than the other layers.
Raw Material Transport Distance	Distribution of raw material transport distances averaged across the archaeological layers of a locality
Australopithecus sediba	Localities containing fossil specimens attributed to Australopithecus sediba



ROAD

ROCEEH – Out of Africa Database



www.roceeh.net > ROAD

ID: public

Password: roceeh



Thank you

for your attention...