

**UNCTAD**

**17th Africa OILGASMINE, Khartoum, 23-26 November 2015**

**Extractive Industries and Sustainable Job Creation**

**The NRDB project: providing Darfur with critical  
datasets to support natural resource  
management and development**

By

Dr. Steven Boger  
Senior Geologist,  
And  
Dr. Heinz W. Kreutzer  
Water Resource Specialist  
GAF AG, Germany

The views expressed are those of the author and do not necessarily reflect  
the views of UNCTAD.

# The NRDB project: providing Darfur with critical datasets to support natural resource management and development





## Natural Resources and Land Use DataBase and Map for Darfur

The 2011 Doha peace agreement resulted in the establishment of the Darfur Land Commission (DLC)

DCL were tasked with administering the NRDB

Increase institutional and technical capacity to manage and protect Darfur's natural resources, promote economic development, and improve livelihoods



## Natural Resources and Land Use DataBase and Map for Darfur

- i. Socio-economic conditions
- ii. Biology and ecology
- iii. Geomorphology and soils
- iv. Geology and Mineral Resources
- v. Hydrogeology and Water Resources



## Natural Resources and Land Use DataBase and Map for Darfur

- i. Socio-economic conditions
- ii. Biology and ecology
- iii. Geomorphology and soils
- iv. Geology and Mineral Resources
- v. Hydrogeology and Water Resources



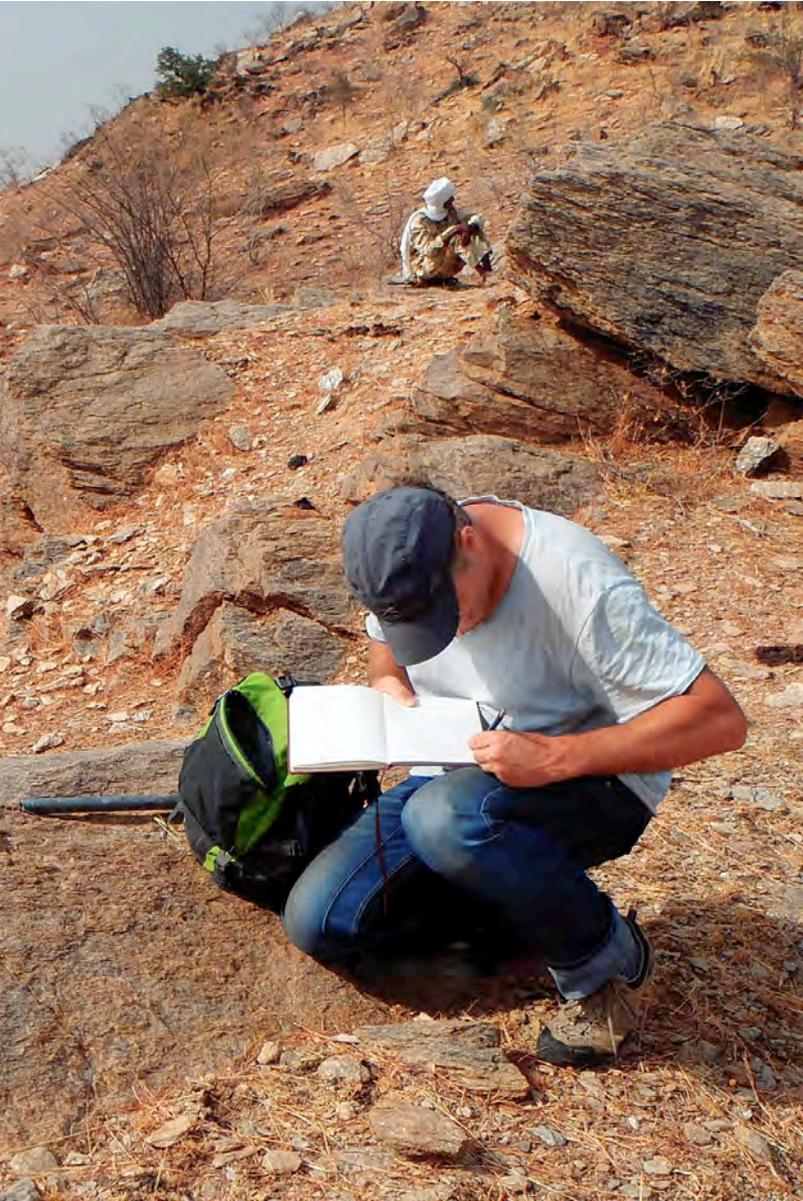
1. Collect demographic, ethnic group and livelihood data
2. Assess the socio-economic situation of the rural and urban populations
3. Assess access to natural resources, health, education, employment and markets



1. Provide base line data on the state of environment, land cover, and land use in Darfur
2. Provide a vegetation inventory and biodiversity assessment
3. Assess of natural and anthropogenic (human) induced changes and dynamics



1. Assess of soils from field studies and laboratory analysis
2. Evaluate land suitability and identify land use potential
3. Produce maps on land systems, geomorphology, soils and land suitability

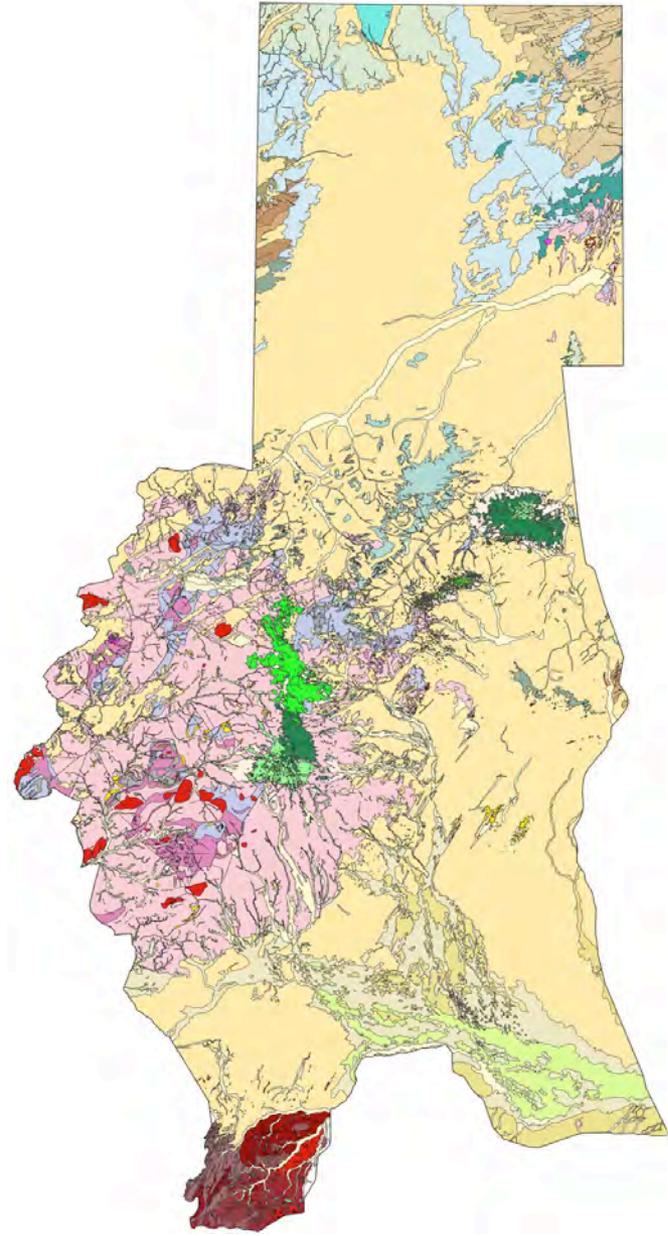


1. Data compilation from previous studies in Darfur
2. Update the geological maps using remote sensing datasets and field verification
3. Petrographic, geochemical and geochronological sampling and analysis



45 new geological maps at 1:250 000 scale

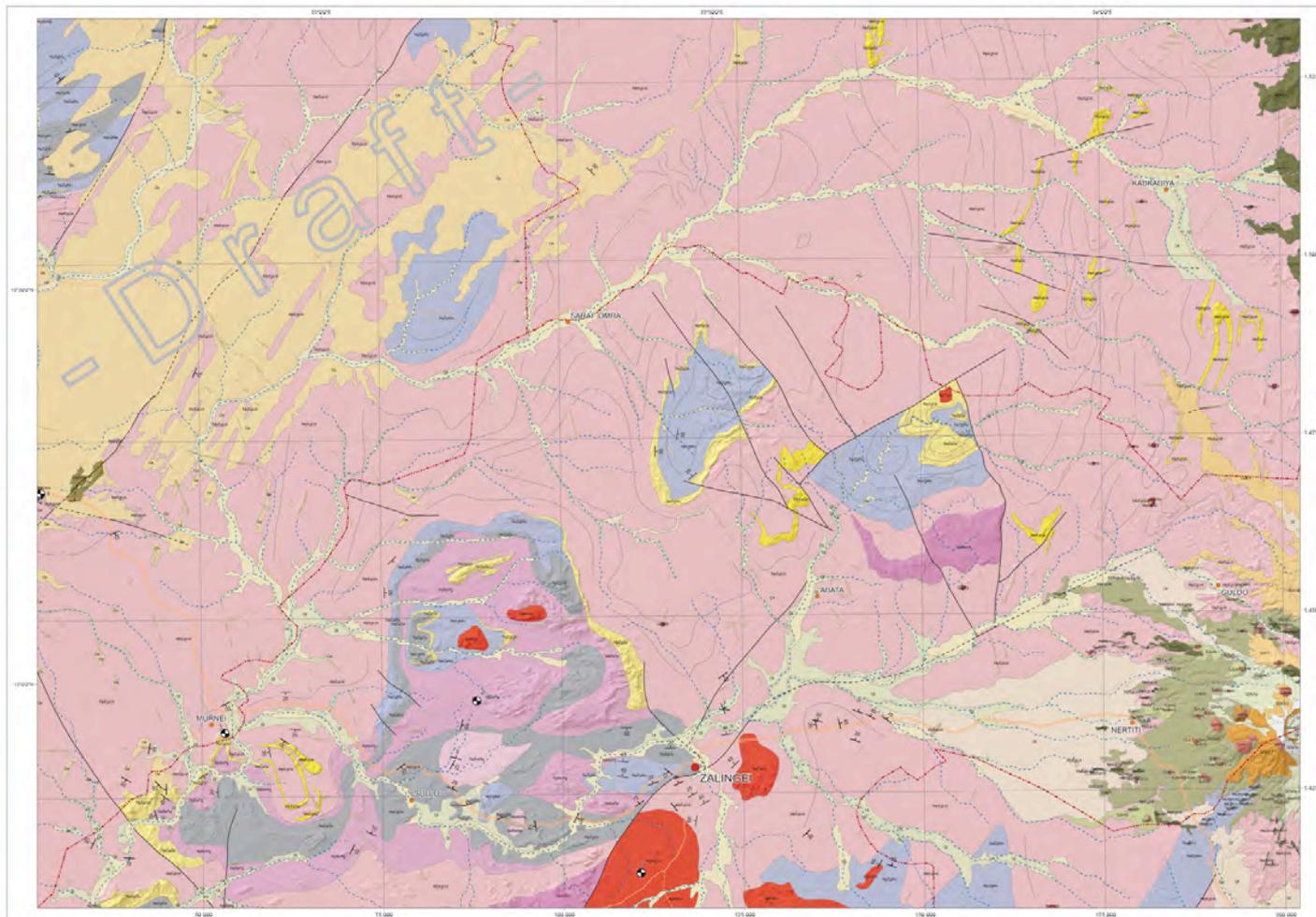
(Previous maps were at 1:1 000 000 scale)





## Darfur Geology

Zalingei



### SYMBOL LEGEND

**STRUCTURAL GEOLOGY**

- Strike and dip symbols (S/D)
- Fault: normal, extension, compression
- Unconformity: angular, disconformity
- Lineament

**HYDROGEOLOGY**

- Levels of ancient sea level (MSL) (m)

**STRATIGRAPHIC LEGEND**

Stratigraphic Unit	Color	Symbol	Description
Quaternary	Yellow	Q1	Recent alluvium (sand, gravel, silt and clay)
Neogene	Orange	N1	Lower Miocene (sandstone, shale, siltstone)
	Red	N2	Upper Miocene (sandstone, shale, siltstone)
	Pink	N3	Lower Pliocene (sandstone, shale, siltstone)
	Light Pink	N4	Upper Pliocene (sandstone, shale, siltstone)
Mesozoic	Green	M1	Lower Cretaceous (sandstone, shale, siltstone)
	Light Green	M2	Upper Cretaceous (sandstone, shale, siltstone)

**Tectonic Relationship Diagram**

**Reference Map**

**Observation Points Darfur**

**Projection:** Universal Transverse Mercator (UTM)  
 Zone 35N, Central Meridian 27° E  
 Datum WGS 1984  
 23°50'00" Coordinates in Degrees, Minutes, Seconds  
 1 250 000 Coordinates in Meters, UTM Zone 35

**Data Source:**  
 Roads derived from Landsat 8, 2013  
 Settlements from Swida (Satellite) 2002  
 Waadis derived from Landsat 7 ETM Mosaic 1999 - 2003  
 Satellite imagery:  
 Landsat TM 3000 Bands 4, 3, 1, paths and rows 176 50-56,  
 177 47-53, 178 40-54, 179 40-53 and 180 50-51,  
 ASTER GDEM S10200, S10100, S10100, S10100  
 ASTER 2009 - 2010, ALOS PALISAR 2010

**Map:**  
 Geological Research Authority of the Sudan / Robertson Research 1988  
 Geological Map of Darfur 1:1 000 000  
 Geological Research Authority of the Sudan / GEO3 Berlin 2004:  
 Geological Map of the Sudan 1:5 000 000  
 Geological Research Authority of the Sudan / GEO3 Berlin 2005:  
 Geological Map of Shimali Darfur State 1:1 500 000  
 Geological Map of Janubi Darfur State 1:1 500 000  
 Geological Map of Gharbi Darfur State 1:1 500 000  
 Hilalwanji R. B. M. Messerer: U Ripari (TFH Berlin) 1990.  
 Geological Interpretation Map of Jebel Marra 1:100 000

1 : 250 000



Prepared in the framework of the Natural Resources and Land Use Database and Map for Darfur Project (NRDB) on behalf of





First robust geochronological dataset for Darfur (U-Pb zircon)

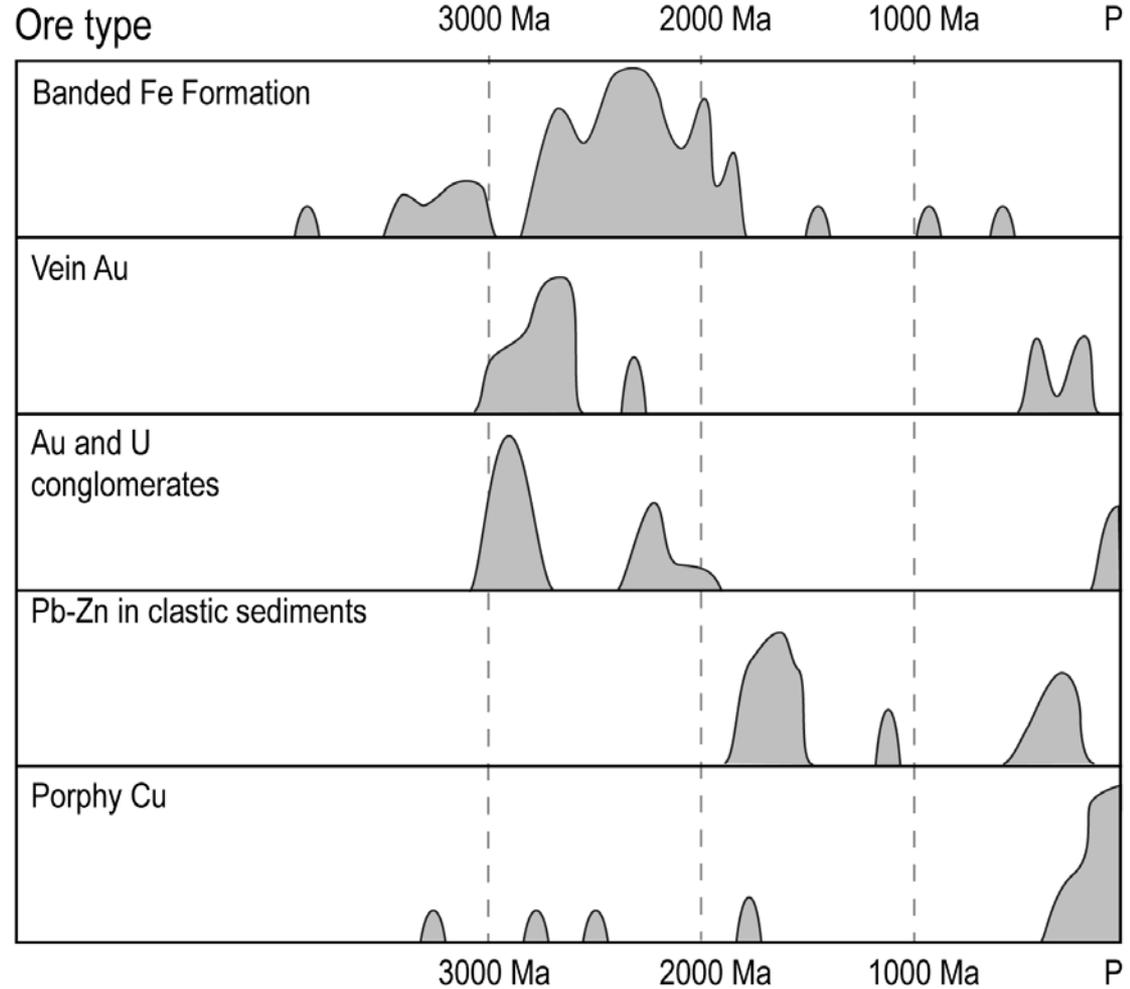
First regional geochemical dataset for Darfur (whole rock, trace and rare earth elements)

Extended the existing Nd-Sr-Pb isotopic database

Some samples sent for precious and base metal assaying



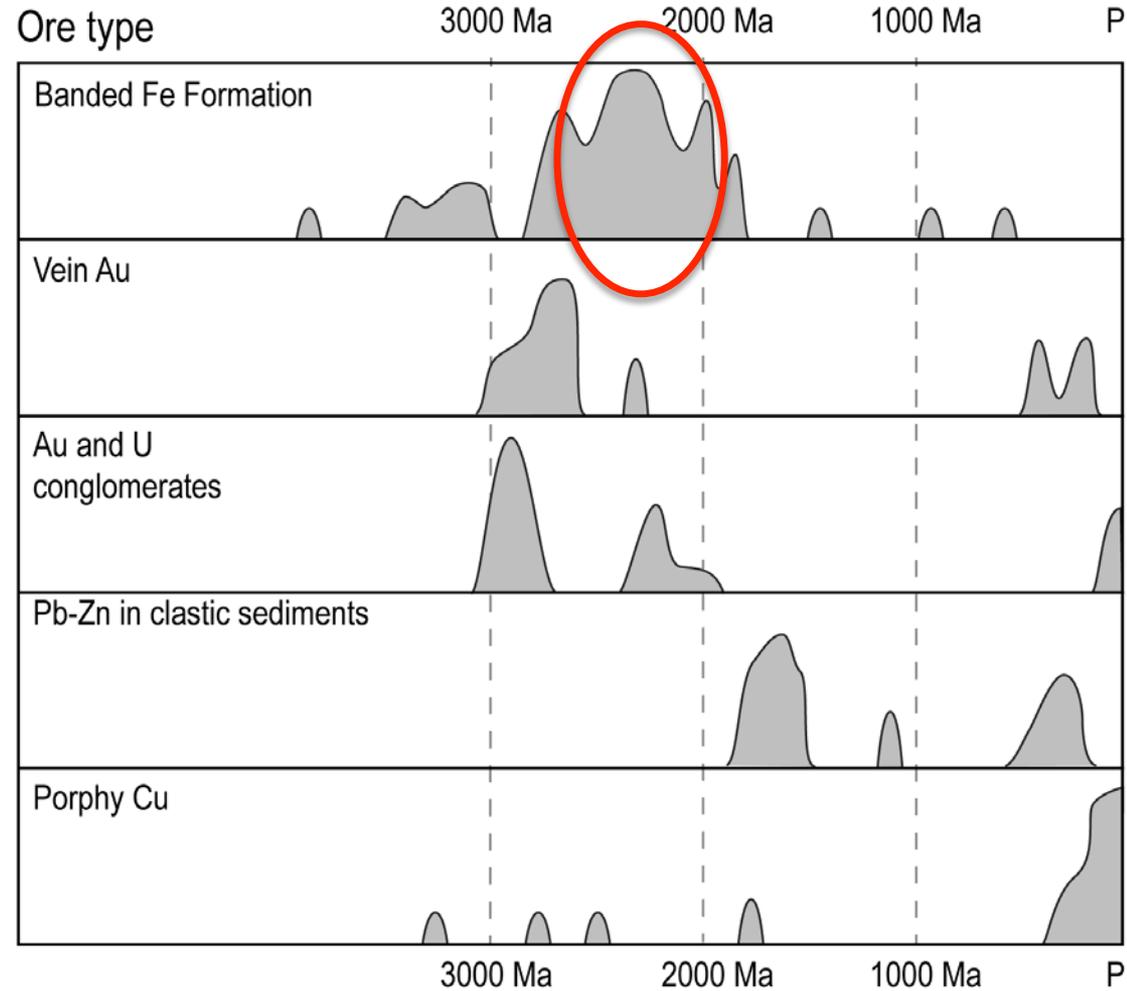
There are epochs in Earth history that are better endowed with mineral wealth than others





There are epochs in Earth history that are better endowed with mineral wealth than others

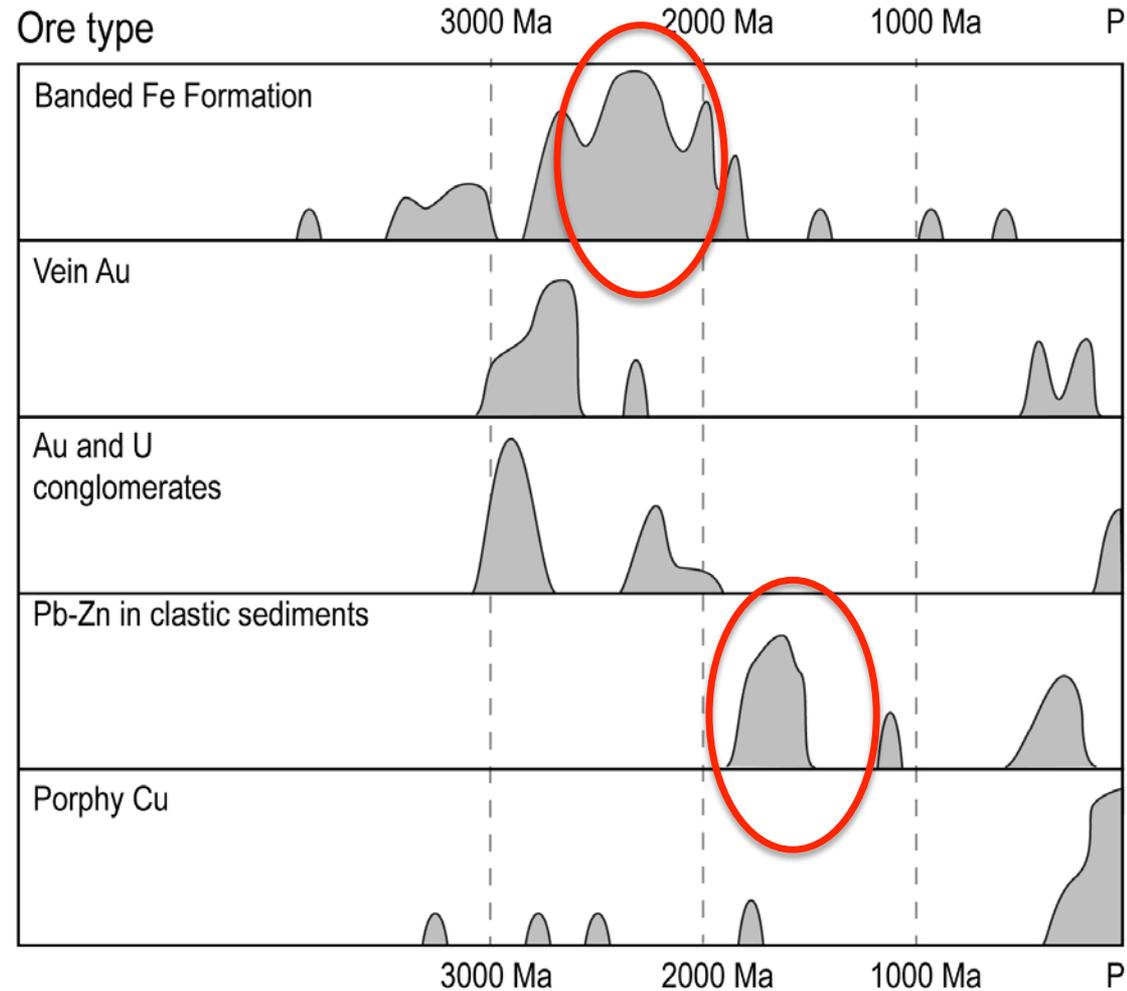
- i. Most significant iron ore deposits were formed in the early Palaeoproterozoic

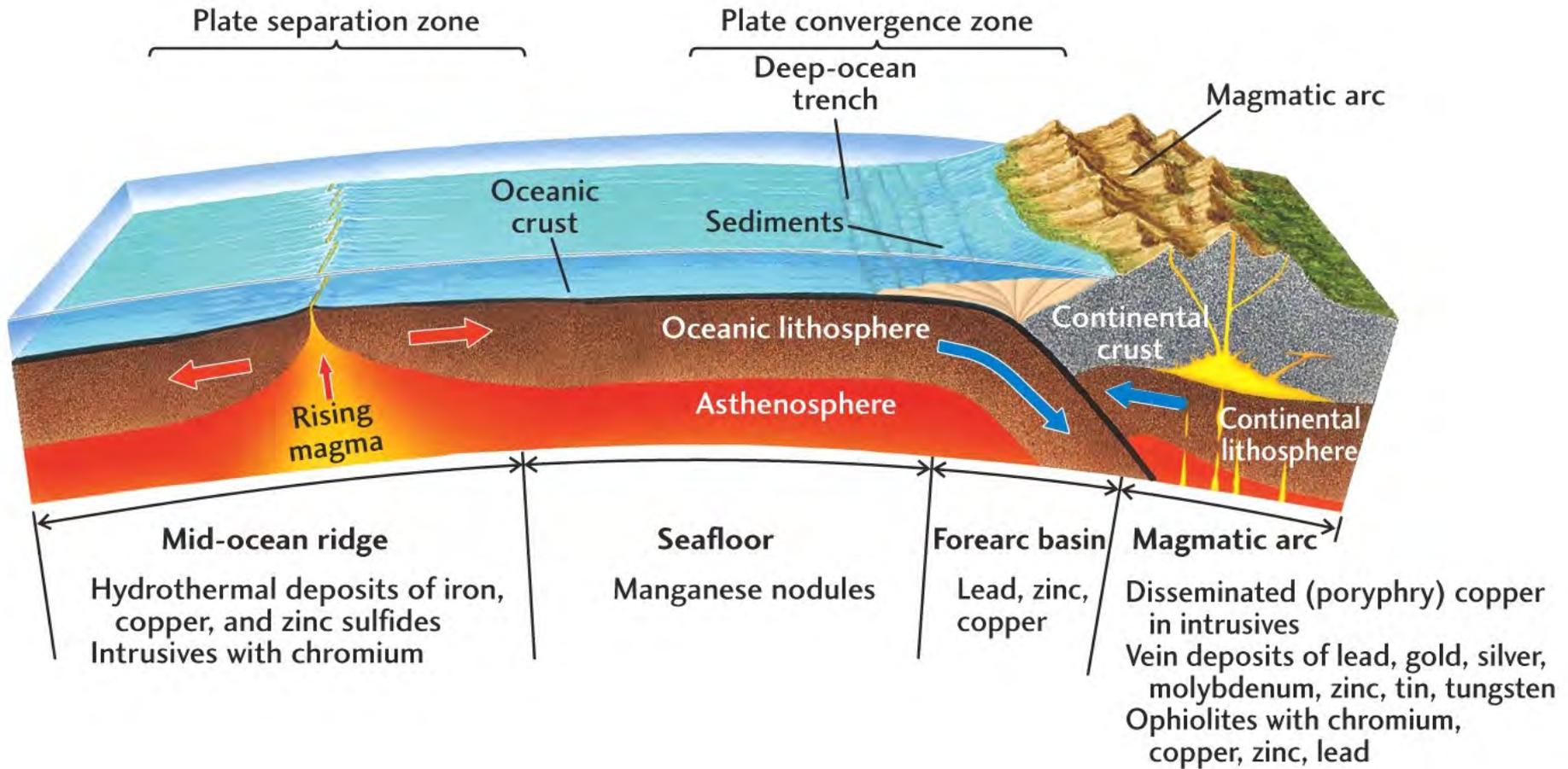




There are epochs in Earth history that are better endowed with mineral wealth than others

- i. Most significant iron ore deposits were formed in the early Palaeoproterozoic
- ii. Most significant Pb-Zn-Ag deposits date to the middle Palaeoproterozoic





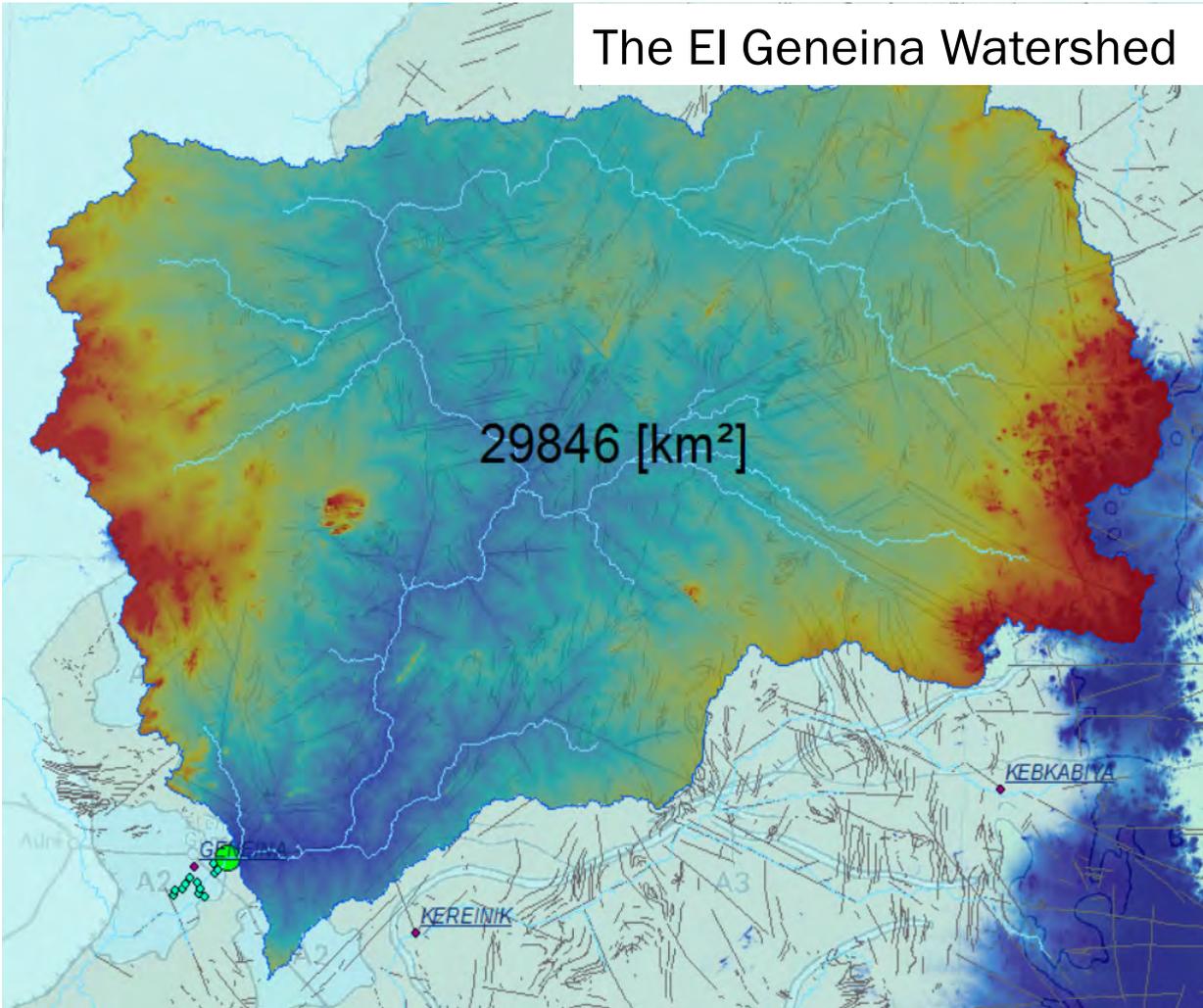
Very different rock types and mineral deposits are formed in different tectonic settings



1. Calculate and map the drainage network and watersheds of Darfur
2. Use historical and satellite meteorological data to calculate the water budget of Darfur
3. Use of available water well points to produce hydrogeological maps
4. Measure groundwater chemistry and morphology



The El Geneina Watershed



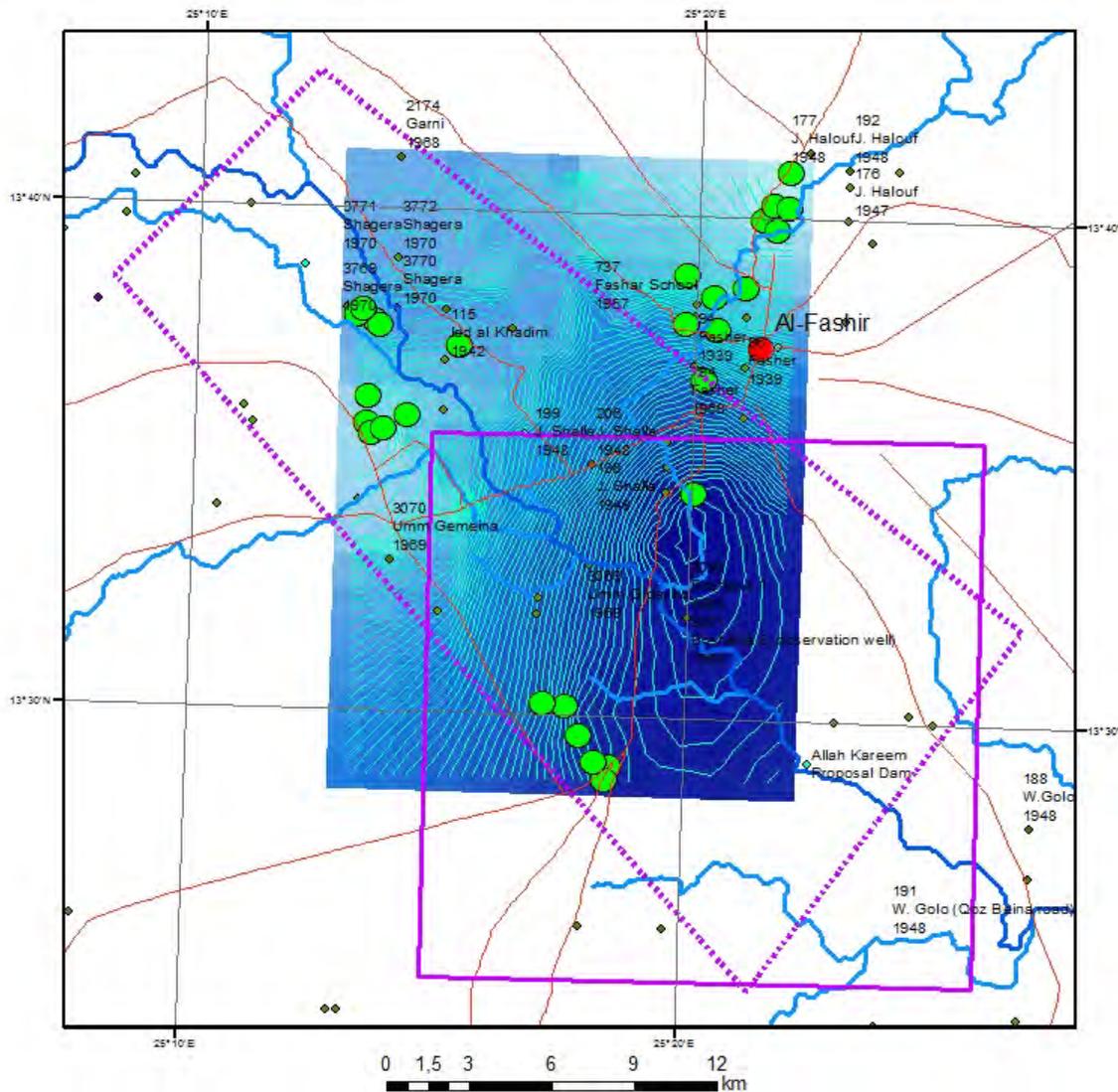
Calculate the water volume available at El Geneina for annual recharge or run off.



Regional high precision (to the mm) measurement of the water table allowed for the determination of the water table morphology and annual recharge mechanisms



## Wadi El Ku SWL May 2012



### Legend

- GAF\_WMP\_12-13\_v2\_
- Drainage lines (Aster)

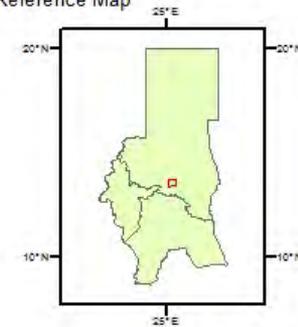
### AOI

- AOI Wadi El Ku - Golo
- AOI 50k Special Interest

### Infrastructure

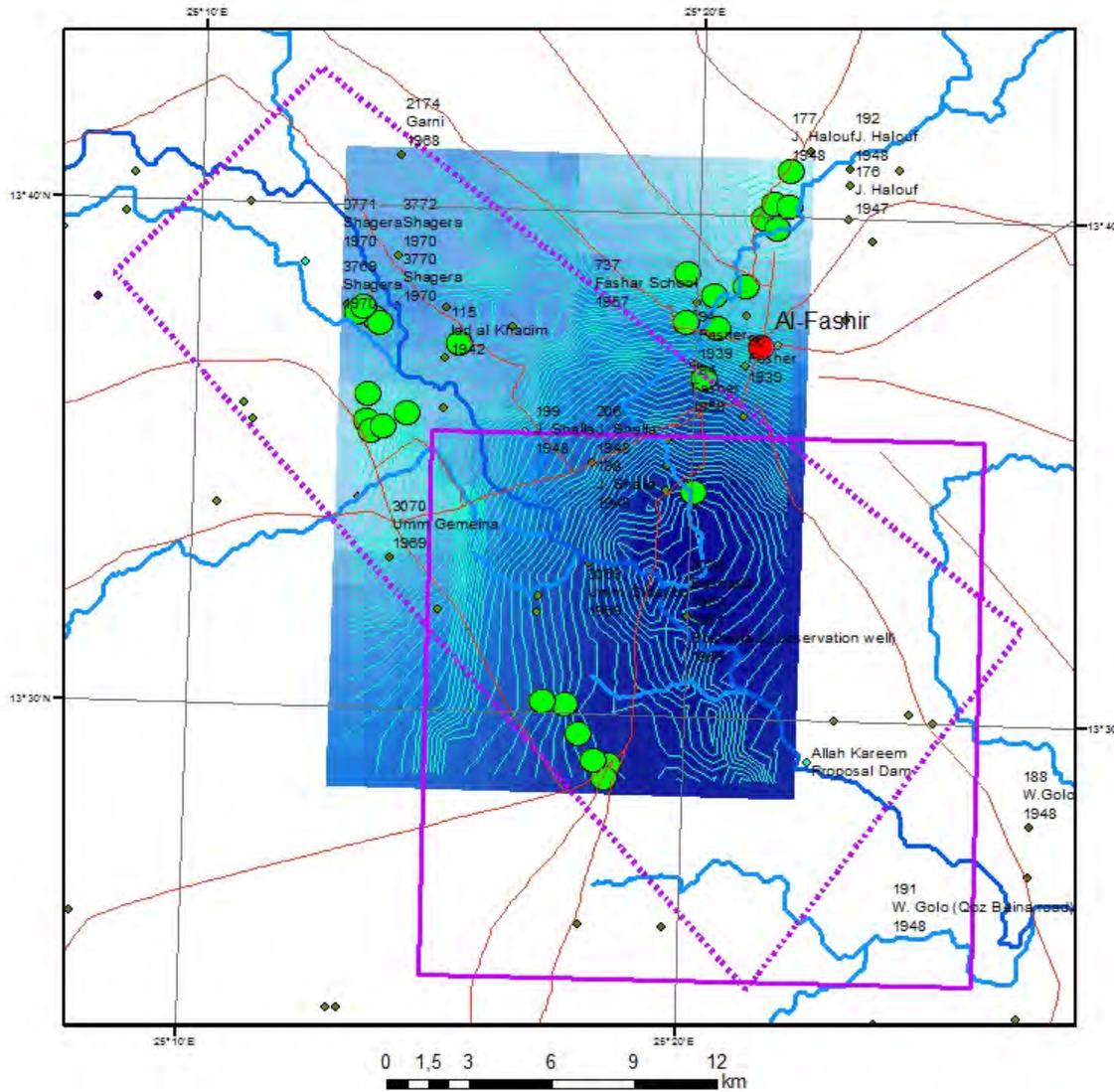
- Town
- Road

### Reference Map





## Wadi El Ku SWL Aug 2012



### Legend

- GAF\_WMP\_12-13\_v2\_
- Drainage lines (Aster)

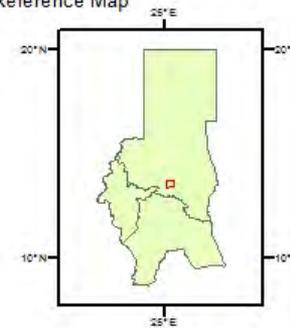
### AOI

- AOI Wadi El Ku - Golo
- AOI 50k Special Interest

### Infrastructure

- Town
- Road

### Reference Map







Located in the Adacama Desert

1. 3100m above sea level
2. receives 15mm rainfall per year
3. 170 km from the coast



BHP Escondida Cu Mine, Chile



Located in the Adacama Desert

1. 3100m above sea level
2. receives 15mm rainfall per year
3. 170 km from the coast

The mine consumes 80 000 ML of water per year

One Olympic sized swimming pool = 2.5 ML



BHP Escondida Cu Mine, Chile



Located in the Adacama Desert

1. 3100m above sea level
2. receives 15mm rainfall per year
3. 170 km from the coast

The mine consumes 80 000 ML of water per year

One Olympic sized swimming pool = 2.5 ML

Water is now sourced from a desalination plant located on the coast

**Construction cost \$ 2 billion**



**BHP Escondida Cu Mine, Chile**

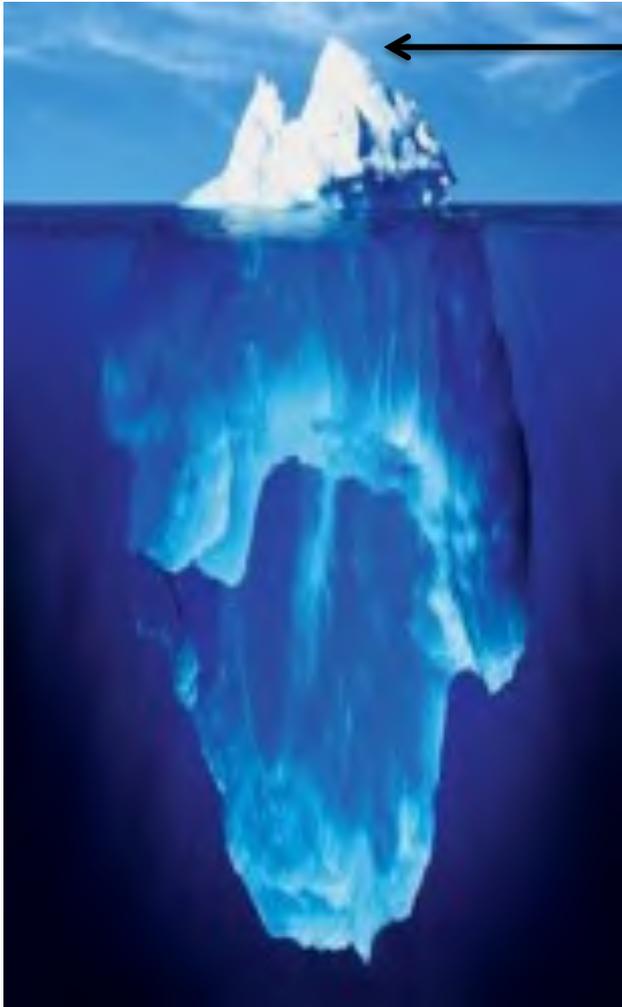


## Natural Resources and Land Use DataBase and Map for Darfur

- i. Socio-economic conditions
- ii. Biology and ecology
- iii. Geomorphology and soils
- iv. Geology and Mineral Resources
- v. Hydrogeology and Water Resources

The datasets are there to facilitate development in Darfur

Data will be available from the Darfur Land Commission in 2016!



My presentation

Come and see the NRDB project stall in the pavilion...

Many thanks for your attention!