Establishing and running the first Master program Petroleum Geology at the University of Dar es Salaam (Tanzania): lessons from the past and plans for the future

G. Bertotti, Nelson Boniface, Hans de Bresser, Hudson Nkotagu and Frank van Ruitenbeek
The history: we did it and we did it fast

The “pre-history”

- **March 2013**: identification mission responding to the request of assistance of the Tanzanian (Union) Minister of Energy and Minerals
- **April 2013**: Visit of President Kikwete and Minister of Energy and Minerals to the NL
- Visit of a delegation from the Zanzibar House of Representatives and several Ministries and regular contacts of the Embassy
- **December 2013**: establishment and funding of K2K NL unit
- **February 2014**: contacts with UDSM and discussion on K2K project during NL mission to Tanzania and Zanzibar (with Minister Ploumen)

May 2014

- Workshop with most TZ Organizations
  - UDSM (Geology, Chemistry and Mining Engineering), DIT (Mining Engineering), Nelson Mandela Institute, UDOM (College of Earth Sciences), GST, Mineral resource Institute (Dodoma)
- **A frank and open discussion**

October 2014

- **Accreditation of the UDSM plan by TUC**
challenges

- **Management of expectations:** Activities are restricted by requirements of funder, money, availability of university teachers

- **Finding solutions that fit all:** Dutch government, UDSM, NL universities:
  - BSc versus MSc programme support
  - Training of students versus training of staff
  - Teaching methods versus petroleum geology

- Integrate TZ and International students
Key points

- All classes given at UDSM (participants invited also from other Institutions)
- Lecturers both from UDSM and NL
- Involving local stakeholders

Pros:
- Establishment of critical mass of students and scientific staff
- Strengthening network of TZ and NL scientists - impact on sustainability
- Involves local stakeholders (companies, universities, government)
- Students stay close to family and home
- Cost efficient

Cons:
- Students get limited exposure to international environment and state of the art facilities
- Difficult to find time for university teachers to teach abroad
Making it possible
The official opening
The official opening
To work!
The courses given

- Advanced Petroleum Geology
- Rock Properties, Petrophysics and Well Log Analysis
- Stratigraphy and Sedimentology
- Seismic Data Acquisition and Processing
- Gravity, Magnetics and Remote Sensing
- Environmental pollution prevention and control
- Petroleum Basin Analysis
- Seismic data Interpretation
- Scientific Writing
- Petroleum Structural Geology
- Petroleum Production
- Paleontology and Palynology
- Reservoir diagenesis and quality

light blue for courses given by UDSM
Excellent results

Grade Point Average

excellent

very good
A first (subjective) evaluation

Good news

• The participating students are very motivated and have a strong background
• We were all satisfied with the level of the courses
• Burocracy, logistics etc have worked (nearly) perfectly

To be improved

• Remote supervision and tutoring remains a challenge
• Counter-part system did not work as hoped
The next step: MSc projects

- Scientifically challenging topics for the 13 students
- Projects to be performed partly in small groups and partly individually. The common part stimulates synergy and discussion and facilitates (remote) supervision
- Co-supervision of TZ and NL researchers
- Projects closely linked to Industry (BG, Statoil, Shell, TOTAL...)
- Links with other Universities (Oslo, Aberdeen) and TZ partners (TPDC, and other)?
Master projects

**Sedimentology and structural geology of outcropping analogs**
(mainly quarries)
- Carbonate reefs in the Dar Es Salaam area
- Mixed siliciclastic-carbonate

**Regional seismic lines**
- Hydrocarbon seeps
- Balancing and restoration of sections through faulted basins
- Mechanic model of a section across the Tanzania margin
- Tectono-sedimentary evolution

**3D seismic cubes**
- Fault analysis and implications for HC exploration
- Fault analysis and implications for stress and strain field

**Other topics**
- Innovative methods for the determination of rock maturity

Looking for TZ data sets!
1. Early syn-rift, key for the distribution of source rocks

Initial rifting is accommodated by numerous small faults most of which die out within <10Myr
These basins are small and isolated creating ideal conditions for stratified water columns and anoxic conditions.
Linkage is an important component

Is there more?

Cowie 2005
Project 1a: evolution of syn-rift fault kinematics

Fault throw analysis along strike and from horizon to horizon provides useful additional structural information.

It helps pinpointing complex histories of fault development and related HC play suggestions.
Faults in Suriname (work by H. de Bresser)

Appendix 0

Length/Throw: 2
Length/Displ.: 2
Strike: 72

Length/Throw: 117
Length/Displ.: 87
Strike: 78
1b Cooling and strengthening are important. A thermal anomaly at the onset of rifting is common.
2. Passive margins are not so passive

These unconformities hide kms-scale movements during the late syn-rift and early post rift

Combining low-T geochronology and sedimentology
Late Triassic to Early Jurassic
Where did the sands go?
How were they transported to the offshore?
For this we need to go to the subsiding part of the system.

Syn-sedimentary, Late Jurassic to Early Cretaceous folding is widespread.
The anticlines formed small relief on the sea floor.

Strong ravinement surface

Tamri section
Jurassic-Cretaceous anticlines control distribution in the continental shelf during the Late Jurassic.
E-W structures are key factors controlling entry points

Luber et al 2015
Master of Science: the scientific challenges

3 Cheap and fast determinations of paleo-temperatures: spectral thermometry

Determining paleo-temperatures and ages of thermal events is key

SWIR Camera in the field!
Preliminary regional results are promising!
The (near) future: good news

Tanzania-Netherlands Energy Project

NICHE/TZA/260
NICHE proposal, new components:

Geothermics

Build on Kenya’s success
NICHE proposal, new components:

Vocational training
Exciting times ahead!
We need you, together we can make a difference