Welcome to Part 2: Synoptic Studies of the East African Rift System

Conveners:
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³ Syracuse University
⁴ Penn State University
The East African Rift System (EARS)

- 4 major rift branches
  - Main Ethiopian Rift
  - Western Branch
  - Eastern Branch
  - Southwestern Branch
QUESTION 1: What questions are of interest to the community that concerning synoptic studies of the east African Rift System?

QUESTION 2: What datasets exist and what is needed to address system-wide studies of the East African Rift?

QUESTION 3: Is there interest in a community-driven proposal? (Yes/No/Maybe)
Example EARS Synoptic Study

• 6 major rift branches?
  – Main Ethiopian Rift
  – Western Branch
  – Eastern Branch
  – Southwestern Branch
  – Southeastern Branch?
  – Southern Branch?
Example EARS Synoptic Study

- Distribution of seismicity (NEIC catalog + Rambolamanana Madagascar network $>M_0 4$)
- vs. distribution of volcanic activity (NGDC)
Example EARS Synoptic Study

- Distribution of seismicity (NEIC catalog + Rambolamanana Madagascar network $> M_o 4$)
- vs. distribution of volcanic activity (NGDC)
Example Dataset

- GPS data available at [www.unavco.org]
- Search AFREF African Reference Frame initiative for additional continuous GPS stations/data
Example Dataset/Base Model

- Gravitational Potential Energy Calculations
  - Stamps et al., 2010
  - CRUST2.0 (Bassin et al., 2000)
  - Lateral variations in upper mantle density and uniform mantle density available
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What makes a Community Experiment?

- The community acquires a large (geophysical) data set.
- PI’s are supported only to perform experiment and collect data
- Involvement and training of junior scientists and students.
- The data become publicly available immediately.
- Mechanism for ensuring rapid turnaround of necessary data processing
- Money to support individual research analyses (including students, etc.) is provided through subsequent, separate proposals
Examples of Community Experiments

- EarthScope’s Transportable Array and Plate Boundary Observatory
- Cascadia Initiative
- Holbrook Cascadia Langseth Experiment
- GeoPRISMS Eastern North American Margin experiment
What makes a Community Proposal?

- overarching science, and the general experiment location, are specified by community consensus
  - via a workshop, open meetings, online polls, etc.
- broad group (perhaps self selected, but not exclusively so) volunteers to write the proposal, and serve as PI’s on the experiment
- Expresses science motivation, and articulates a particular experiment to address science, but no research.
  - Broad enough to allow for multiple subsequent analysis
  - focused enough to be tractable and compelling
- Utilize participant support funding to involve and train junior scientists and students
  - Data acquisition
  - Data processing
Data acquisition on land and at sea in April 2014, Sept/Oct 2014
Challenges of Community Experiments

- Proposal must sell science, but without analyses spelled out or guaranteed
- PI commitment likely larger than funded, and unpredictable
- Logistics! Field experiments are hard! Tons of busywork (shipping, establishing partnerships, pursuing leveraging opportunities, managing expenses). Do you want to do this for something that is not “yours”? 
- Producing community-ready data volumes is very tough, especially on a tight schedule. Have a very specific plan, and make sure funding is adequate to support it
Datasets

Wendy Nelson\textsuperscript{2}, Rob Moucha\textsuperscript{3}, Andy Nyblade\textsuperscript{4}

1 University of Houston
2 Syracuse University
3 Penn State University
Geochemical Data Sets

- Volcanism over 45 Ma
- Data consists of
  - Whole rock and mineral compositional data.
  - Melt inclusion compositional data
  - Volatile contents preserved in minerals
- Major element, trace element, and isotopic data.
- Age Determinations

Pik et al., 1998 (top); Rooney et al. 2012 (bottom)
Geochemical Data Sets

- EarthChem by NSF (http://www.earthchem.org/)
  - “...community driven effort to facilitate preservation, discovery, and access and visualization of data...”

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Geochemical Data Sets

IEDA EarthChem Homepage

Welcome to EarthChem.

This web site gives you access to data systems and services for geochemical, geochronological, and petrological data, developed and maintained by EarthChem, including the EarthChem Library, the EarthChem Portal, PetDB, NAVDAT, SEDDB, and Geochron.

EarthChem develops and maintains databases, software, and services.
Geochemical Data Sets

- **GEOROC** (http://georoc.mpch-mainz.gwdg.de)
  - Geochemistry of Rocks of Oceans and Continents
  - **Most comprehensive database for EARS volcanic rocks and xenoliths**
  - Maintained by Max Planck Institute for Chemistry (Germany)
The database GEOROC (Geochemistry of Rocks of the Oceans and Continents) is maintained by the Max Planck Institute for Chemistry in Mainz. The database is a comprehensive collection of published analyses of volcanic rocks and mantle xenoliths. It contains major and trace element concentrations, radiogenic and nonradiogenic isotope ratios as well as analytical ages for whole rocks, glasses, minerals and inclusions. Samples come from 11 different geological settings. Metadata include, among others, geographic location with latitude and longitude, rock class and rock type, alteration grade, analytical method, laboratory, reference materials and references.

Currently, GEOROC contains about 673,000 analyses of almost 365,000 samples, published in more than 11,900 papers (for a complete list of references available in GEOROC, click here).

Applications of the database GEOROC are numerous in the study of volcanic rocks but also in sedimentary, palaeoceanographic, as well as atmospheric research (more).

GEOROC can also accessed by the EarthChem's web portal that offers distributed searches across several databases including the databases PetDB and NAVDAT. Datasets in GEOROC are cross-linked with GeoReM, an MPI database for reference materials of geological and environmental interest, such as rock powders, synthetic and natural glasses as well as minerals, isotopic, biological, river water and seawater reference materials.
Geochemical Data Sets

- GEOROC

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- **PetDB** (http://www.earthchem.org/petdb)
  - Petrological Database of the Ocean Floor
  - Maintained by EarthChem and supported by NSF
  - Limitations:
    - Igneous and metamorphic rocks of the ocean floor
    - Mantle xenoliths (new)
“Other” Geochemical Data Sets

- **GERM** ([http://earthref.org/GERM](http://earthref.org/GERM))
  - Geochemical Earth Reference Models
  - Supported by Scripps and Oregon State University (NSF sponsored)
  - Limitations:
    - Good resource for global reference materials, partition coefficients, etc.
    - Does not contain basic data published in location-specific papers.

- **Geochron** ([http://www.geochron.org](http://www.geochron.org))
  - Maintained by EarthChem and supported by NSF
  - Limitations:
    - New database
    - Clunky user interface
Changing Dynamic Topography of the African Continent

(Moucha et al., Nature Geo, 2011)
Evolution of East African Rift Topography

a) Dynamic Topography Profile

b) Dynamic Topography Profile with respect to 30 Ma
Landscape Evolution and the role of the EARS

Iteration 5: TX2008V2, 30 Myr
Resolution: 4 x 4 km

Sedimentary flux Record
Congo Margin
51 stations
48 seismic stations
27 GPS/met stations
19 countries
Continuous recording
Data recovery 70-80%
Data availability: IRIS and UNAVCO
Data retrieval:
  - A few countries - real-time using cell modems
  - Elsewhere - monthly

AfricaArray Observatory Network
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