East Africa Paleodrainage Systems – Reservoir Quality Predictors
an Energy & Geoscience Institute research proposal

Rationale

Drainage system evolution affects reservoir distribution and quality. Sediment sources will change through time as tectonic forces cause rifting, drifting, uplift and subsidence. These forces result in physiographic features that will act as transport pathways (i.e., fluvial drainage patterns) or barriers (i.e., uplifted mountain belts) to deposition.

The distribution and thickness of reservoir units are controlled by an interplay of:

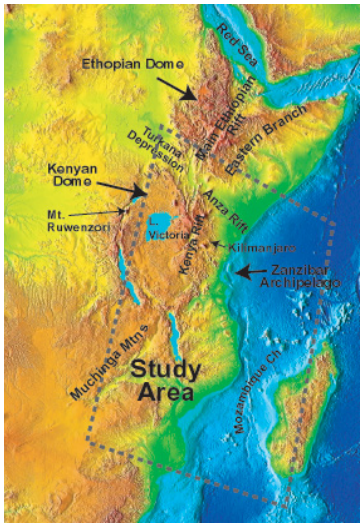
1. fluvial drainage systems – type, extent and distributary features;
2. tectonic rift pulses or stages – length of time for rifting and between tectonic episodes; width of the adjacent hinge zone;
3. type and thickness of hinterland/continental materials that form the drainage basin and provide material for erosion and redeposition; and
4. paleoclimate – rainfall and temperature.

Reservoir quality can be inferred by comparing outcrop and onshore mineralogic data with potential transport pathways into the basin. Relative ages of fluvial systems and their paleodrainage patterns also can be predicted based upon fault-displacement principles.

Present-day physiography displayed in bathymetric maps and digital elevation models is used as a proxy for determining the seaward extent of paleodrainage systems. Large rivers cut across the shelf and disgorge sediment onto the continental slope and into the deep basin during low sea level stands. During high sea level conditions, large rivers generally build deltas onto the continental shelf. Small rivers become stranded and usually do not contribute to continental margin development during regressive intervals. Theories regarding sedimentation and physical modification of the continental margin have been developed since the early 1970's and are best summarized on a global scale by Burk and Drake (1974).

Proposal

EGI proposes to delineate paleodrainage systems of East Africa to facilitate reservoir evaluation. The area for consideration is outlined to the right.



Data and Methods

Geomorphologic data will be accessed from a variety of sources:

1. Digital elevation model data will be accessed from NOAA and the USGS at a 90-meter scale. This data will form the base maps for the geologic, tectonic and evolutionary components of the project.
2. Landsat 30-meter data (and 15-meter panchromatic band) will be purchased and merged with spectral data to produce colorized versions of the geomorphology from which we can trace paleodrainage channels from the onshore to the offshore. Landsat 3D maps will be produced by draping the Landsat maps over the 3D digital elevation model products.
3. Selected areas will be chosen from the above imagery for Fe^{+2} or Fe^{+3} analyses to infer the potential reservoir quality of recognized paleodrainage channels.
4. The Landsat and digital elevation model data will be utilized for geomorphometric evaluation in which we mathematically generate indices of extension to trace the paths of potential paleodrainage systems into the offshore basins.
5. Bathymetric data will be evaluated to determine the potential for paleochannel development and point-source *vs.* non-point source sediment distribution over time.

Geologic and Structural data includes tectonic, geologic and structural maps of the region that will be compiled from the literature and used to produce an integrated evaluation for the evolution of East Africa. We will utilize published well and geophysical data to complete the dataset.

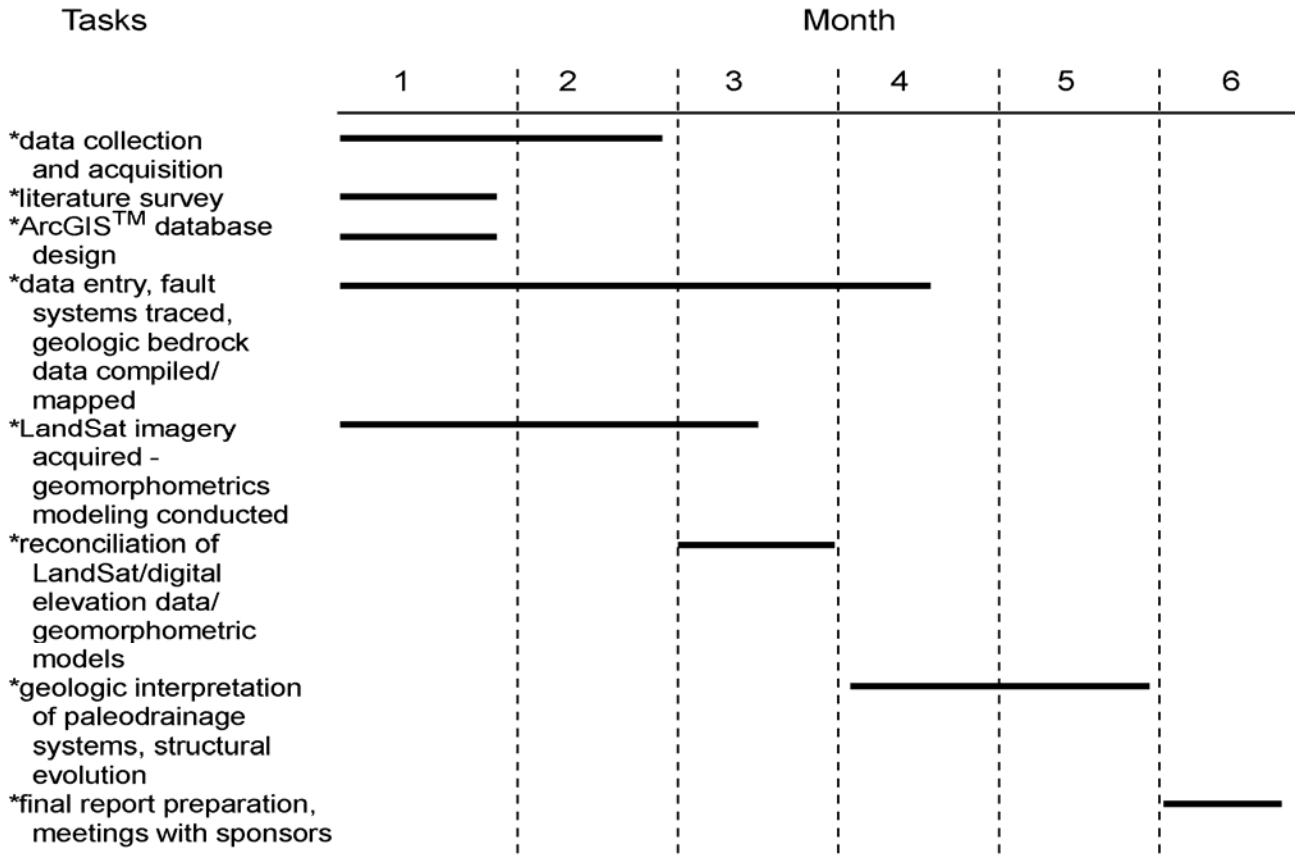
Deliverables

Specific deliverables will include:

1. a series of maps outlining the paleodrainage system evolution from the late Jurassic through the Miocene; and
2. lithologic logs depicting Jurassic through Miocene sedimentologic units (i.e., provenance and facies).
3. identification and characterization of submarine canyons for interpreting relative age and timing of depositional pulses. This will be accomplished by comparing the size and morphology of the submarine canyons with modern river systems to evaluate their competence and continuity.
4. an ArcGIS™ database containing fault systems, drainage channels, bedrock geology, and detailed digital elevation models for comparing present drainage systems with interpreted paleodrainage channels;

The final report will be delivered in hard-copy and digital format. The text will describe methods utilized in the study, potential provenance sources and probable distribution pathways. All maps and lithologic logs will be prepared in ArcGIS™ format. Images also will be provided in .jpg format for presentation purposes. The project will be completed within six months of initiation.

Time Line



Budget

The total budget for each sponsor is $37,500; three sponsors are required to initiate the project. If desired, the project can be conducted as a sole-sponsored program, in which case it will not be available to the general membership until 2008.

East Africa Paleodrainage Systems	
EGI Salaries	$ 101,305
Other Costs	11,213
Total Budget	**$ 112,517**
Number of Sponsors	3.00
Cost per Sponsor	37,506

Personnel

The project will involve key EGI personnel:
Dr. Marylin Segall – project development, oversight, geological data interpretation
Dr. Greg Nash – leader, Geospatial Datasystems Team, structural geologist – design and interpretation of satellite-derived imagery and geomorphometrics
Dr. Richardson Allen – structural geologist with extensive experience utilizing ArcGIS™ for problem-solving applications; student supervision
Mr. Christopher Kesler – ArcGIS™ data system design; online data access delivery manager
Students – data entry

Contact Information:

Marylin P. Segall, Ph.D. or **Mr. David Curtiss**
Principal Investigator **Manager of International Strategy & Development**
Tel: 801-585-5730 **801-587-7925**
mpsegall@egi.utah.edu **dcurtiss@egi.utah.edu**

Preliminary Report Outline

Introduction

- generalized geology background: tectonics, bedrock fabric and composition, and sedimentology

Paleo-drainage systems

- potential paleo-fluvial transport pathways
- comparison of modern river systems with submarine canyons on the adjacent margins

Provenance

- bedrock geology and evolving source terrains
- onshore distribution of potential reservoir facies and quality

Summary and Conclusions

- identification of paleo-drainage systems
- prediction of potential reservoir sands the developed through time with emphasis on quantity, distribution and quality concerns

References