Geology of the Area South of Magadi, Kenya

GEOLOGIC HISTORY

HOLOCENE
Evaporite Series (0-9 ka): trona with interbedded clays. The Magadi Soda Company currently mines the trona at Lake Magadi in the region to the north. Samples of this formation from Natron indicate significantly more halite than trona compared to Lake Magadi (Bell and Simonetti 1996).

PLEISTOCENE
High Magadi Beds (9-23.7 ka): yellow-brown silts over laminated clays with fish remains. Deposited during a period of higher lake levels in both lakes Natron and Magadi. Coarser pebble beds seen near Lenderut are thought to be fluvial deposits associated with the higher lake stand (Baker 1963).

Natron Lake Beds: reworked volcanic material, fine to medium sand, clay, gravel, and rounded chert pebbles. Magnesite and bentonite clay are found in small outcrops near the shore of Lake Natron (Guest & Pickering, 1966).

Chert Series/Green Beds (40-96 ka): lacustrine chert and associated sediments up to 30 meters thick above Oloronga Beds. Cherts are typically surrounded by a green matrix of erionite tuffs and pyroclastic silts, and may rise diapirically through the High Magadi Beds in the Magadi region (Behr & R hricht 2000, Behr 2002).

Lengorale Trachyte (630-640 ka): quartz trachytes and trachytic tuffs at the southern end of the Nguruman Escarpment that rest directly on the Kirikiti basalts. Originally associated with the Lengitoto trachytes in the Magadi region by Baker (1963), they are now known to be significantly younger (Baker 1971).

Oloronga Beds (300-800 ka): yellow water-lain tuffs are the remnants of a larger and fresher lake (Crossley 1979). About 45 m in outcrop, these sediments overlie the Magadi Trachytes, and contain chert, kunkar limestone, and layers of carbonate boxwork (Baker 1958, Potts et al. 1988). Some hominin artifacts are also associated with these sediments (Shipman et al. 1983).

Ol Doinyo Alasho: small trachytic cone composed of ashes, tuffs and glass scoria. Pumice tuffs, reaching over 18m thick, mantle the plain between Alasho and Shompole (Baker 1963).

Plateau/Magadi Trachyte (0.8-1.4 Ma): fine grained, peralkaline flood trachyte with a medium green to brown-grey matrix, and feldspar phenocrysts up to 0.5cm. This prominent trachyte is found between Lake Natron and Suswa, and is one of the several expansive "flood trachytes" that cover the rift floor.

Gelai (1-1.5 Ma): shield volcano that lacks a summit crater, reaching an elevation of 2942m. Slopes are composed of alkali olivine basalts, and peralkaline trachytes. Peridotite xenoliths may also be present in some basalts and tuff cones. Numerous small scoria and tuff cones are aligned with faults that cut the volcano's slopes (Dawson 2008). A series of seismic events from July-Sept 2007 were focused on the southern flank of this volcano, and may have been related to magmatic dyking (Delvaux et al. 2008).

Shompole (Shombole) (1.96-2 Ma): highly weathered stratovolcano composed of nephelinites, carbonatites and phonolites (Dawson 2008).

Singaraini Basalt (2.31-2.33 Ma): olivine basalts with occasional, small, feldspar phenocrysts. Five flows are exposed in a fault scarp at the Singaraini trigonometrical station, all have normal magnetic polarity, and outcrops are bouldery. See Baker and Mitchell (1976) for a discussion regarding previous correlations and dating of this formation.

Lenderut (2.5-2.7 Ma): highly eroded remains of a volcanic center composed of andesites, tephrites and basanites (Baker 1963).

PLIOCENE
Kirikiti Basalts (2.5-3.1 Ma): olivine basalts with rare plagioclase phenocrysts found in the western section of the map along the Nguruman escarpment. See Crossley (1979) for a discussion of issues regarding previous age dates for these basalts.

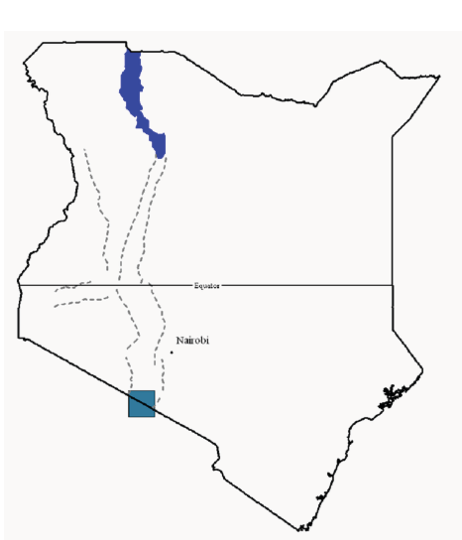
BASEMENT SYSTEM:
Precambrian metamorphic rocks exposed here are part of the Mozambique Belt, which represents the closure of the Mozambique ocean during the Pan-African Orogeny (Nyamai et al. 2003). The Kurase Group has been interpreted as a former shallow shelf environment, while the metamorphosed arkose, greywackes, and basic lavas of the Kasigau group were deposited within a subsiding basin (Warden & Horkel 1984). These sediments have been subjected to several stages of deformation (descriptions in Warden & Horkel 1984), with all but the most recent associated sediments reaching upper amphibolite/granulite grade (Nyamai et al. 2003).

STRUCTURE
This area is cut by numerous "grid faults" that can be seen running roughly parallel to each other in a northeast-southwest fashion. The formation of these faults is thought to have coincided in time with the deposition of the Oloronga lake beds (LeGall et al. 2008), although additional minor faulting has affected the younger lake beds as well (Baker 1958). The large Nguruman escarpment defines the western rift boundary in this area, and the seismic data indicate 3.5 km of rift fill lies in the rift next to this fault (Simiyu & Keller 2001).

The metamorphosed sediments that comprise the basement series exposed in this area were affected by orogenic folding that produced a NNW-SSE foliation. Three folds located in this region (the Ropet syncline, Losirua anticline and Kileu syncline) plunge gently to the NNE (Baker 1963).

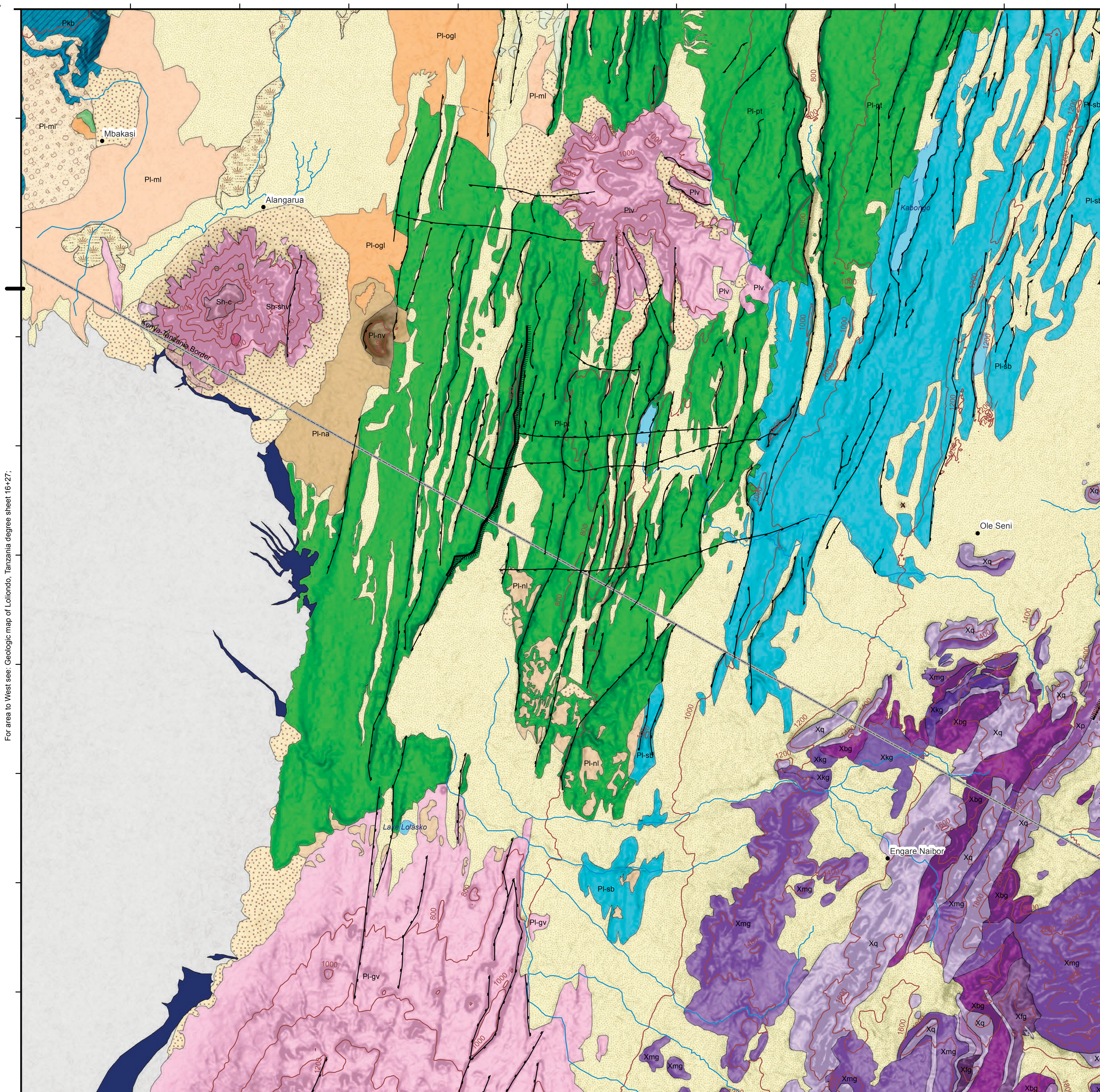
PALEONTOLOGY
No sites are known from this specific mapped area, however hominin sites are known to exist on the western shore of Lake Natron, where the Peninj Group Sediments (1.1-1.2 Ma) contain a variety of stone tools and animal remains (Domı´nguez-Rodrigo et al. 2002, Deino et al. 2006).

ECONOMIC DEPOSITS
While the Magadi Soda Company has occupied the shores of the lake Magadi since 1911, there is no active mining of the trona at Lake Natron. Potentially economic quantities of kyanite are associated with the gneisses in the Losirua area, and the same area also contains a source of graphite (Baker 1963).



Above: Location of presented geologic map (grey-square) in relation to the major rift bounding faults and Lake Turkana.

For area to North see: Geology of the Magadi Area, KGS Report 42; Digital version by A. Guth



For area to West see: Geologic map of Loliondo, Tanzania degree sheet 16+27.

For area to East see: Geology of the Namanga-Bissel Area, KGS Report 39; Digital version by A. Guth

0 5 10 20 30 Kilometers

N W E S

Legend

Sediments

Holocene

- Trona
- Alluvial fan
- Lacustrine Sediments

Pleistocene

- Pl-mf Pebble Beds
- Pl-ml High Magadi Beds
- Pl-c Magadi Green Beds
- Pl-ogl Oloronga Lake Beds
- Pl-nl Natron Lake Beds

Volcanics

Pleistocene

- Pl-lgt Lengorale
- Pl-na Alasho ash
- Pl-na Alasho centers
- Pl-pt Magadi Trachyte
- Pl-gv Gelai

Shompole Volcanics

- Pl-shv Shompole
- Sh-c Central vent deposits
- Sh-p3 Type III phonolite
- Sh-p2 Type II phonolite
- Sh-p1 Type I phonolite
- Sh-cb Carbonatite breccia

Pleistocene: Gelasian

- Pl-kb Kirikiti Basalt
- Pl-sb Singaraini
- Plv Lenderut

Metamorphics

Kurase Group

- Xl Crystalline Limestone
- Xp Undiff. Pelitic host
- Xq Quartzite

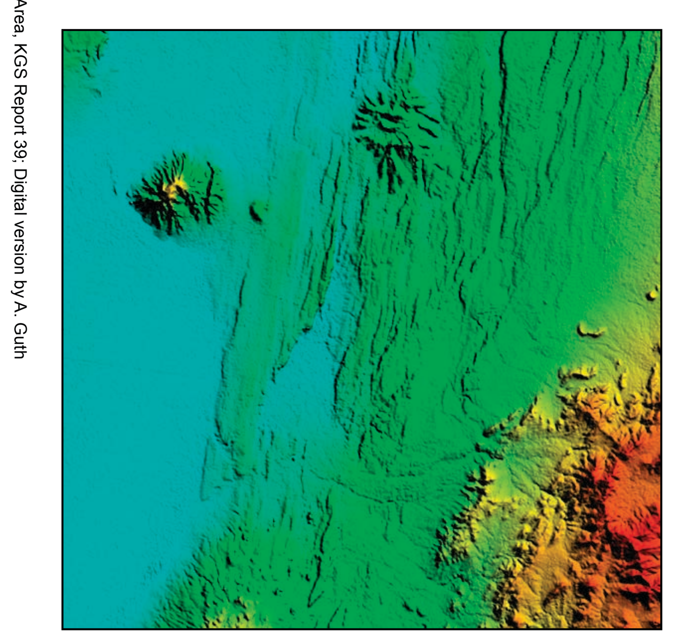
Karigau Group

- Xfg Feldspathic Gneiss
- Xmg Muscovite-biotite gneisses
- Xhg Hornblend gneiss
- Xbg Biotite/Banded Gneiss
- Xkg Kyanite Gneiss

- faults-large
- faults-small
- rivers
- 200m-contour
- City
- Town
- Village
- Road-major
- Road-minor
- Road-track
- rail
- Lake- ephemeral
- Springs
- Swamp

WATER RESOURCES
The Magadi region receives on the order of 475 mm of precipitation per year, making this a semi-arid climate. The Ewaso Ngiro river drains into Lake Natron, which is its terminal basin. This river and associated swamps provide adequate water for the Maasai and their cattle herds, however, the water supply is not sufficient during the dry season to keep the trona surface submerged. The only open water around Lake Natron during the dry season is supplied by brackish or saline springs.

GEOTHERMAL PHENOMENA
The Kenya Rift has a number of geothermally active sites, and both Lakes Magadi and Natron are surrounded by thermal springs. There have been some studies on the potential of geothermal power generation at Lake Magadi (e.g. McKnitt et al. 1989, Clarke et al. 1990), but this section of the rift has yet to be tapped for power generation. Carbon dioxide seeps have been reported from ground fissures in the area (Baker 1963).



Colored DEM with hillshade for the mapped region.
Elevation range from 579 - 2260m (cyan - red).

Reference map showing the source maps and their geographic coverage

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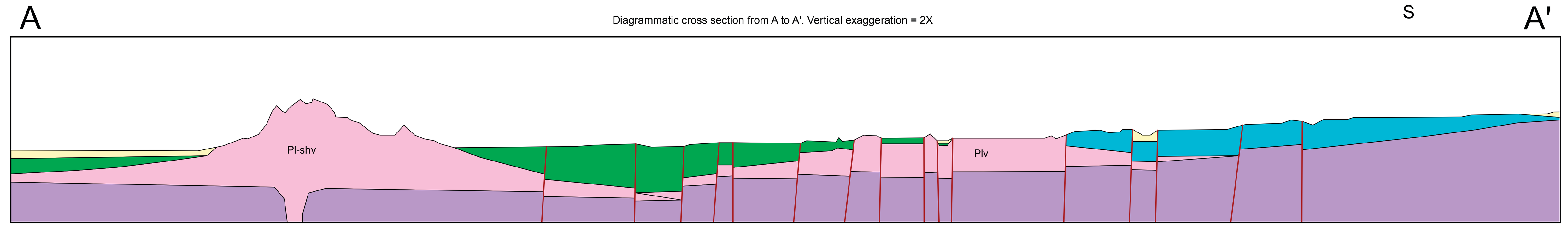
Cross Section Legend

- Lacustrine Sediments
- Magadi Trachyte
- Pl-shv Shompole
- Singaraini
- Plv Lenderut
- Metamorphic

A A'

Diagrammatic cross section from A to A'. Vertical exaggeration = 2X



Geological Map of the Southern Kenya Rift

contour interval 200m

Location: South of Magadi, Kenya 36.0 E - 36.5 E, 2.0 S - 2.5 S	A. Guth, J. Wood (2013)
Coordinate System: Geographic WGS84	Michigan Technological University

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