Geology of the Nairobi Region, Kenya

GEOLOGIC HISTORY

HOLOCENE:
Longonot (0.2 - 400 ka): trachyte stratovolcano and associated deposits. Materials exposed in this map section are comprised of the Longonot Ash Member (3.3 ka) and Lower Trachyte (5.6-3.3 ka). The trachyte lavas were related to cone building, and the airfall tuffs were produced by summit crater formation (Clarke et al. 1990).

PLEISTOCENE:
Kedong Valley Tuff (20-40 ka): trachytic ignimbrites and associated fall deposits created by caldera formation at Longonot. There are at least 5 ignimbrite units, each with a red-brown weathered top. In some regions the pyroclastic glass and pumice has been replaced by calcite (Clarke et al. 1990).

Barajai Trachyte: (0.37-0.41 Ma) five aphyric trachyte flows distinguished from the Plateau Trachytes by Baker et. al (1988) based on element ratios; otherwise they are indistinguishable. May be earliest eruptive products from Suswa. Mapped areas are tentative and based on written description of extent in Baker et. al (1988).

Mt. Margaret: welded and unwelded trachyte tuffs erupted from a small cone that rises 120m above the rift valley floor (Clarke et al. 1990).

Ol Tepesi Basalts (1.4-1.65 Ma): alkaline basalts with sparse plagioclase and olivine phenocrysts (Baker et al. 1977), distinguished by Baker and Mitchell (1976).

Limuru Trachyte (1.94 - 2.64 Ma): contains characteristically clustered groups of K-feldspar phenocrysts, tends to form bouldery outcrops, and grades upwards into pantellerite. These were erupted as a series of conformable flows with reverse polarity, that overtopped the escarpment in this area. A thickness of 400m is exposed in the eastern rift escarpments (Baker et al. 1988).

Tigoni Trachyte: very fine grained trachyte exposed in rivers and where it has been quarried for building stone. Originally named the “Karura Quartz Trachyte”, Saggerson (1991) renamed the formation to avoid confusion with the Karura Trachyte described below.

Karura Trachyte: fine grained grey trachyte between the Tigoni and Kabete trachytes. Similar to the Nairobi Trachyte but is stratigraphically higher and weathers to a spotted appearance (Saggerson 1991).

Kabete/Ruiru Dam Trachyte: grey-green porphyritic trachyte that reaches 30m thick in boreholes. The Ruiru Dam and Kabete trachytes are indistinguishable, though the Ruiru Dam trachyte may be thicker (approx. 60m). Saggerson (1991) suggested these trachytes were equivalent in age.

Ngong Hills (2.53-2.58 Ma): remnants of an old volcanic cone which had an estimated original diameter of 11km prior to being cut by the rift boundary faults. Composed of basanite, tephrite, and some nephelinite, some lavas are noted by Saggerson (1991) to contain megascopic fragments of gneiss. Oldest associated lavas are likely Miocene in age (see Kandizi Phonolite).

PLIOCENE
Kinangop & Kerichwa Valley Tuffs (3.34-3.70 Ma): trachytic tuffs that are often welded, and overlie the Nairobi Trachyte. Ages are from the Kinangop Tuff, with which the Kerichwa tuffs have been correlated (Baker et al. 1988). Ages presented by Saggerson (1991) are considered too old due to presence of feldspars that formed before tuff eruption. Bleaching and clay alteration are common, likely representing weathering prior to the eruption of the Limuru Trachytes (Saggerson 1991).

Narok Agglomerate: light brown agglomerate with numerous lithic clasts, including blocks of trachyte and phonolite. These occupy the same horizon as the Kerichiwa Valley Tuffs (Matheson 1966).

Nairobi Trachyte (3.17-3.45 Ma): greenish-grey trachyte, occasionally with tabular feldspar phenocrysts. A number of thin flows reach a cumulative thickness of 90m. At a quarry in Nairobi this trachyte is separated from the Nairobi Phonolite by a thin tuff (Saggerson 1991).

Kiambu Trachyte: light grey trachyte with numerous feldspar phenocrysts. In some regions lava is vesicular with green chalcedony amygdules. Likely a single flow of limited extent, maximum thickness is 46m, and it is overlain by the Nairobi Trachyte (Saggerson 1991).

Nairobi Phonolite (5.20 Ma): black to blue phonolite erupted as a number of flows. Upper flow sections are vesicular, but amygdules are rare. Can be distinguished from the Kapiti phonolites by the lack of large phenocrysts (Saggerson 1991).

MIOCENE
Esayeti (5.64-5.85 Ma): volcanic center comprised of phonolite, tephrite and trachyte flows which partially overlie early Ngong eruptives. Maximum elevation is 2085m, but the cone is highly eroded.

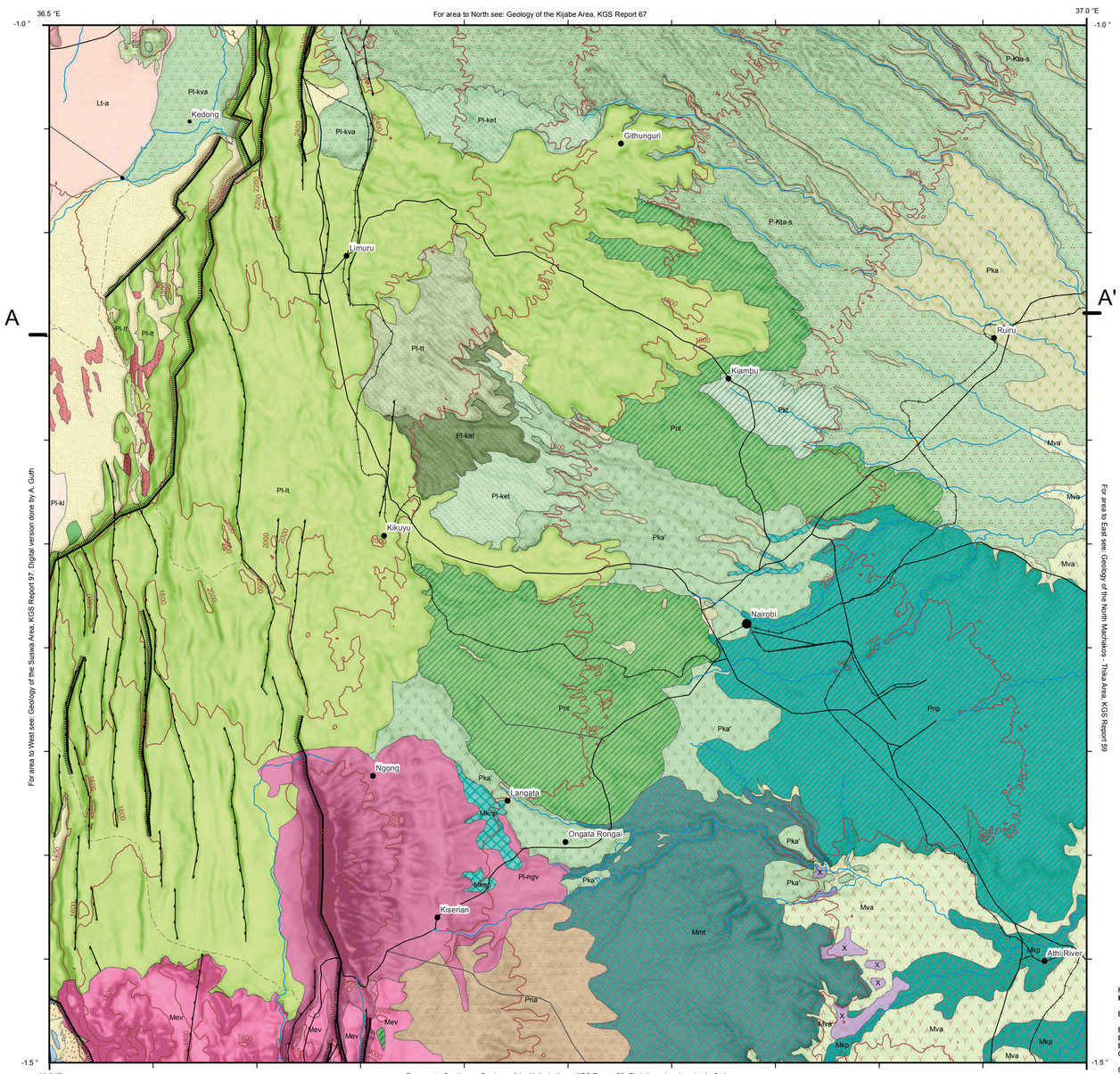
Kandizi Phonolite: black to dark blue with outcrops exhibiting spheroidal weathering. Flow structures indicating an origin to the west, and comparable mineralogy, led Saggerson (1991) to suggest Ngong as a source for this phonolite.

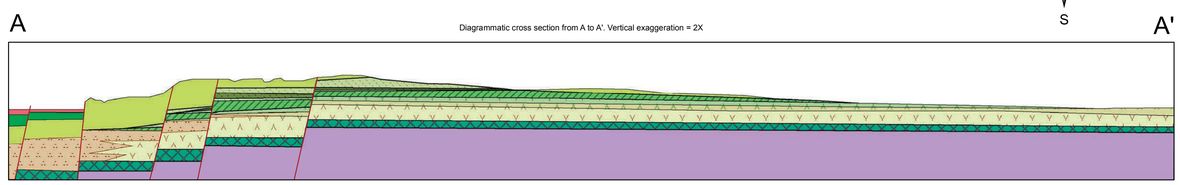
Mbagathi Trachyte: grey-brown phonolitic trachytes with abundant, flow-oriented, feldspar laths of up to 1cm. The formation is comprised of 2-3 flows with a minimum total thickness of 60m (Saggerson 1991).

Athi Tuffs: trachytic tuffs that are sometimes welded, with materials deposited both subaerially and in lacustrine settings. Correlation and mapping of this formation has been noted to have difficulties, and more detailed field studies would be needed to discern the true extent of these tuffs (Saggerson 1991).

Kapiti Phonolite (12.9-13.4 Ma): dark green to black groundmass. Large (<76 mm) white feldspar and nepheline phenocrysts make this phonolite quite distinctive. These phonolites were erupted onto the eroded, irregular, surface of the underlaying metamorphic rocks (Saggerson 1991).

BASEMENT SYSTEM:
Exposures are described by Saggerson (1991) as highly weathered, layered schists and gneisses of various composition. The metamorphic rocks are thought to represent sediments that were altered during the closure of the ancient Mozambique ocean (Nyamai et al. 2003). K-Ar dates on biotite place the cooling and uplifting of these rocks in the Cambrian.





Legend

Sediments
- Alluvial fan
- Kedong Lake Sediments
- Pl-kl Lacustrine Sediments

Volcanics

Holocene
- Pl-ltv Longonot lower trachyte
- Pl-lta Longonot ashes

Pleistocene: Upper
- Pl-kvt Kedong Valley Tuff

Pleistocene: Ionian
- S1 Suswa shield trachytes
- Pl-bt Barajai Trachyte,
- Pl-mv Mt Margaret

Pleistocene: Calabrian
- Pl-tb Tepesi Basalt

Pleistocene: Gelasian
- Pl-ltz Limuru Pantellerite
- Pl-lt Limuru Trachyte
- Pl-lt Tigoni Trachyte
- Pl-krt Karura Trachyte
- Pl-ket Kabete Trachyte
- Pl-ngv Ngong Hills

Pliocene
- P-Kta-s Kinangop Tuff soils
- P-Kta Kinangop Tuff
- Pka U. Kerichwa Tuffs
- Pkal L. Kerichwa Tuff
- Pna Narok Agglomerate
- Pnt Nairobi Trachyte
- Pkt Kiambu Trachyte
- Pnp Nairobi Phonolite

Miocene
- Mev Esayeti
- Mkngt Kandizi Phonolite
- Mva Athi Tuffs
- Mmt Mbagathi Trachyte
- Mkp Kapiti Phonolite

Metamorphics
- X Undifferentiated

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

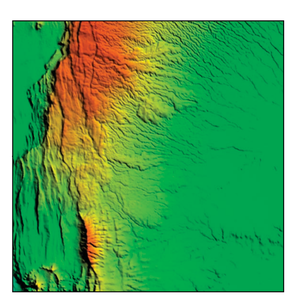
STRUCTURE
The metamorphic rocks have been subjected to several stages of deformation (descriptions in Warden & Horkel 1984), but the recent rift volcanics are relatively undeformed. Many low magnitude tremors have been recorded, but the January 6, 1928 quake (Ms 6.9) near Lake Bogoria indicates the modern potential for large earthquakes associated with the rift boundary faults (Zielke & Strecker 2009).

PALEONTOLOGY
Bones and plant remains were found in the sediments of the Kandizi river valley, as well as the teeth/tusks of Hippopotamus gorgops. Handaxes have also been reported from the area around the Gicheru diatomite beds. Chert flakes and tools have also been found in Nairobi National Park (Saggerson 1991).

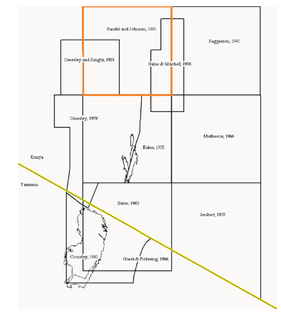
ECONOMIC DEPOSITS
Many of the volcanic rocks are quarried as building stones, especially the Kerichwa Valley Tuff which provides the "Nairobi Stone". Diatomite from the Munyu wa Gicheru lake deposits, 1.65-1.96 Ma (not shown, Trauth et al. 2007) and ferricrete are also excavated in this region.

WATER RESOURCES
The rivers draining the Kikuyu highlands are perennial, and a good aquifer exists between the Kerichwa Valley Tuffs and the underlying phonolite. However, the fluoride content tends to be high (Saggerson 1991).

GEOTHERMAL PHENOMENA
Elevated carbon dioxide soil gas and an active fumarole (89°C), are associated with Mt. Margaret. Silicified pyroclastic material suggests more vigorous geothermal activity in the past (Clarke et al. 1990).



Colored DEM with hillshade for the mapped region.
Elevation range from 1120 - 2430m (cyan - red).



Reference map showing the source maps and their geographic coverage

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Cross Section Legend

Pleistocene
- Lacustrine Sediments
- Suswa
- Magadi Trachyte
- Limuru Trachyte
- Tigoni Trachyte
- Karura Trachyte
- Kabete Trachyte

Neogene
- Nairobi Trachyte
- U. Kerichwa Tuffs
- L. Kerichwa Tuff

Miocene
- Athi Tuffs
- Kinangop Tuff
- Phonolites

Metamorphic
- Undiff.

Above: Map showing featured quadrangle location (grey-square) as well as major rift bounding faults and Lake Turkana.

Geological Map of the Southern Kenya Rift

contour interval 200m

Location: Nairobi, Kenya 36.5 E - 37.0 E, 1.0 S - 1.5 S	A. Guth, J. Wood (2013)
Coordinate System: Geographic WGS84	Michigan Technological University

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