

THE GEOLOGY AND MINERAL RESOURCE POTENTIAL OF KENYA

Overview of the Geology of Kenya

The geology of Kenya may generally be grouped into the following five major geological successions: Archean (Nyanzian and Kavirondian), Proterozoic (Mozambique Belt and Bukoban), Palaeozoic/Mesozoic sediments, Tertiary/Quaternary volcanics and Tertiary/Quaternary sediments.

Quaternary

Soils, alluvial beach sands, evaporates, fossil coral reefs and sandstones at the coast: alluvial and lacustrine sediments of the Rift Valley. There are also volcanic rocks of the rift valley from the younger volcanoes.

Tertiary

Coastal sediments, Late Miocene and Pliocene volcanics, terrestrial and lacustrine inland sediments. There are early Tertiary formations not represented at surface.

Palaeozoic/Mesozoic

The Karroo formations of the coastal hinterland, including the basal sedimentary formation in north-east Kenya.

Proterozoic

Kisii series (Bukoban system): Volcanics with sediments

Mozambique Belt: quartzites, biotite/hornblende gneisses, schist, granitoid gneisses, amphibolites, migmatites.

Intrusives: syntectonic granites

Archean

Kavirondian system: Mudstones, Sandstones, Conglomerates, Granitic intrusions

Nyanzian system: Shales, cherts, ironstones, Pyroclastics, Rhyolites, Andesites, Basalts.

1. *The Nyanzian Shield*

The Nyanzian and Kavirondian systems forming the Nyanza Craton are the oldest rocks in the country with ages over 2,500 million years.

The Nyanzian system is mainly composed of lavas and pyroclastics with minor sediments and banded ironstones. The Kavirondian, which rests uncomfortably on the Nyanzian, consists of grits, sandstones, greywackes and conglomerates. Both the Nyanzian and Kavirondian systems are isoclinally folded about axes that have an east-westerly trend. Kavirondian, is only slightly younger than Nyanzian but folding in the two systems has similar orientation. Numerous granitic bosses and batholiths have intruded the Nyanzian

and Kavirondian. The Kavirondian intrusions were more but the pre-Kavirondian were also widespread and the two systems are discernible.

2. *Mozambique Belt*

The Mozambique belt is a structural unit within which a wide variety of meta-sedimentary and meta-igneous rocks are found showing a broad concordance of structural style and metamorphic history. In most of these rocks, the degree of deformation is intense and is of high metamorphic grades. They were thus referred to earlier in literature as the basement system rocks, due to high degree of metamorphism and deformation.

Recent work on the Mozambique Belt has shown that rocks can be sub-divided into groups of contrasting lithology, structure and composition of igneous rocks content. These groups are being studied in greater detail in order to come up with proper chronostratigraphic terminology.

Within the Mozambique Belt basic igneous complexes are found and range in size from bosses to small dykes. They occur both east and west of the Rift Valley. Some of the older basic intrusions have undergone deformation and metamorphism to give ortho- amphibolites and charnockitic gneisses.

Basic and granitic intrusions are known in the Mozambique Belt. The most characteristic feature of the Mozambique Belt is its structural trend which is more or less north-south in its entire belt.

Variations of the northerly trend are minor and when observed can be explained and are localised. The majority of Mozambique rocks have been placed in upper Precambrian (Proterozoic).

3. *Palaeozoic and Mesozoic Formations*

Palaeozoic and Mesozoic formations in Kenya are found near the coast and in north-eastern Kenya. The earliest of these rocks are Permo-Carboniferous which are mostly sandstones and shales that form the Duruma series. This is equivalent to the Karroo system in Southern Africa. The local formations are Taru; Maji-ya-Chumvi; Mariakani and the Mazeras. They extend for about 100 kilometres from Taru to Mazeras, west of Mombasa. The rocks dip very gently towards the ocean and are heavily faulted in places.

Mesozoic rocks occur in two separate areas, in the north-east part of Kenya and along the Coast belt. The stratigraphy and fossils in the two areas are very distinct and it is likely that the sedimentary basins in the two areas were connected. Revision mapping in the area has come up with interesting lithological units that have revised lithological names.

4. *Tertiary and Quaternary Volcanics*

Volcanic rocks cover the central parts of the country from south to north, occurring in the floor of the Rift Valley and on the penplains west and east of the valley.

The oldest of the volcanics are of Lower Miocene age and comprise the eroded lavas and pyroclastic piles of South Nyanza. Late in Miocene times, Kapiti and Yatta phonolites were erupted and flowed to great lengths.

Further eruptions accompanied by faulting persisted and also gave rise to the Rift Valley and the volcanic piles of Mounts Kenya, Elgon and Kilimanjaro.

Quaternary volcanism was mostly within the Rift Valley and has given rise to the craters and cinder cones that are found in the floor of the valley e.g. Longonot, Menengai and Suswa.

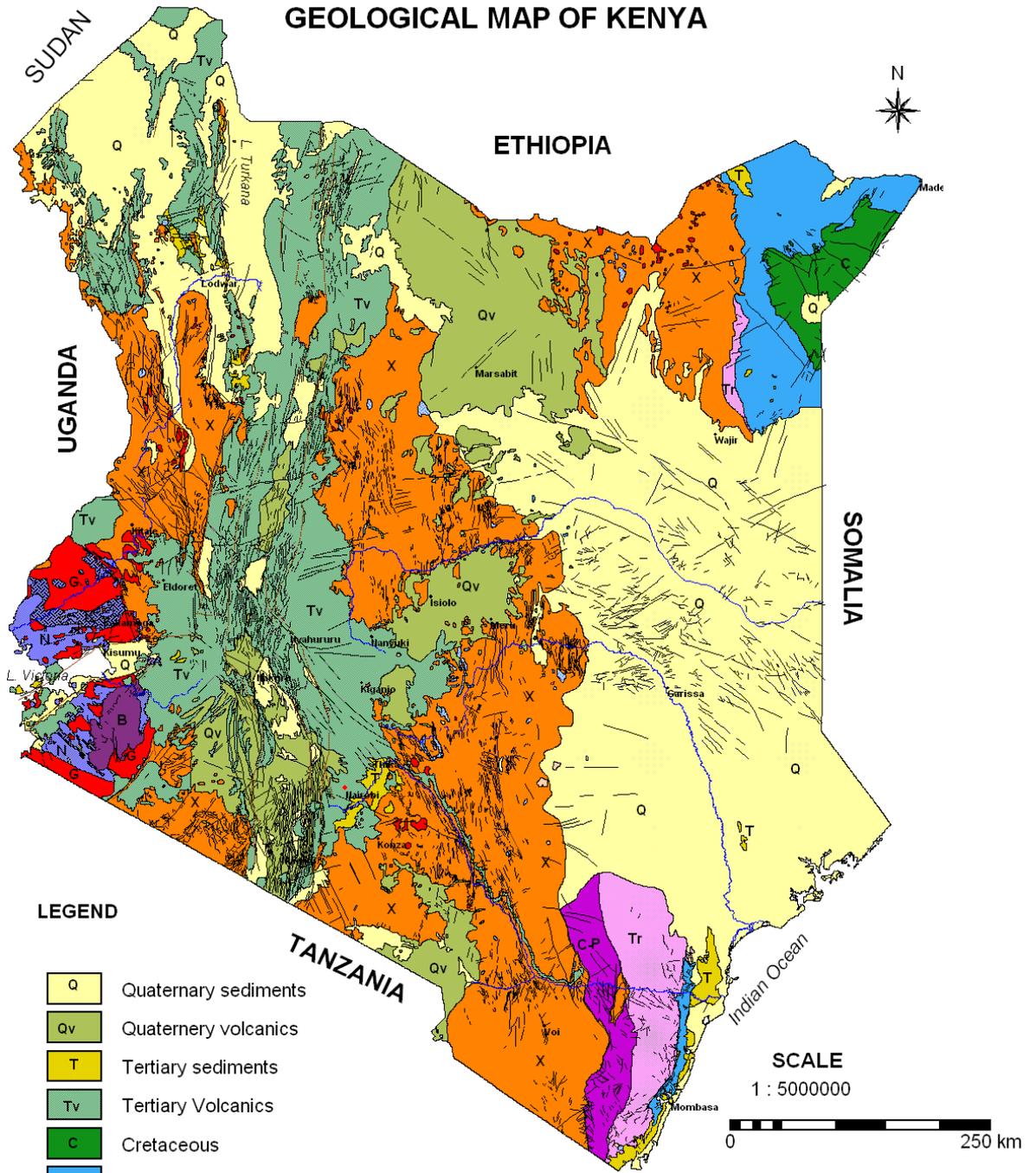
5. *Tertiary and Quaternary Sediments*

There are many deposits of sediments in various parts of Kenya. They usually occur at the base of volcanic succession, intercalated with it or occurring in tectonic troughs.

The repeated faulting of the Rift Valley floor and the numerous volcanic eruptions created many short-lived basins of internal drainage in which lacustrine and fluvial sediments accumulated. Most of these sediments are unfossiliferous, but a few are of interest as they contain deposits that bear artefacts and interesting fossils that have been studied extensively.

The more important sediments of middle Pleistocene are the Olorgesailie lakebeds, a lacustrine series with much diatomite, mammalian fossils and artefacts. This is also comparable to the Kariandusi sediments near Gilgil and the Kanjera Beds in the Kavirondo Gulf off Lake Victoria. Olorgesailie beds and Kariandusi sediments are in the Rift Valley.

GEOLOGICAL MAP OF KENYA



LEGEND

- | | | | |
|---|---|---|---------------------|
| Q | Quaternary sediments | G | Granites |
| Qv | Quaternary volcanics | A | Alkaline Intrusives |
| T | Tertiary sediments | Y | Other Intrusives |
| Tv | Tertiary Volcanics | | Faults |
| C | Cretaceous | | Rivers |
| J | Jurassic | | |
| Tr | Triassic | | |
| C-P | Carboniferous?-Permian | | |
| B | Bukoban | | |
| X | Basement | | |
| | Kavirondian K Ablun series A, Embu series | | |
| N | Nyanzian | | |

SCALE
1 : 5000000

0 ————— 250 km

Overview of mineral occurrence

A wide range of minerals, both metallic and industrial, are known to occur in the country. These include barite, gypsum, gold, silver, lead, talc, titanium, salt, a variety of gemstones, (mainly ruby and several varieties of garnets) dimension stones, silica sand, heavy mineral sands, manganese, zinc, wollastonite, graphite, kaolin, copper, nickel, chromite, pyrite, various clays, rare earth elements and pyrochlore.

The Geological environments for the mineralization can be summarised as follows:

(a) The Archean Nyanzian Craton area of Western Kenya where metallic mineralization of base and precious metals are known to occur: **gold, copper** and **silver** have been mined in the past. They are also potential for ferrous and non-ferrous metals. Kimberlitic bodies have also been reported.

(b) The Proterozoic Mozambique Belt that is most extensive in Central Kenya north to South in which minerals such as **kyanite, corundum, graphite, wollastonite, marble, asbestos, fluorspar, magnesite, kaolin** and a variety of **gemstones** are found together with minerals associated with basic and granitic rocks.

(c) The sedimentary rocks of Palaeozoic to Quaternary are widespread. These rocks are sources and hosts of limestone, **gypsum, clays, manganese** and construction materials and possibly hydrocarbons. Base metal mineralization, **lead-zinc-barite** and **copper** are known to occur in the sedimentary basin along the coastal belt.

Heavy mineral sands also occur along the coastal beach sands and Recent deposits of about 3.2 billion tons of titanium bearing have been discovered.

(d) The volcanic rocks associated with Rift System host a variety of minerals and construction materials. The volcano-sedimentary accumulations have deposits of **clays, evaporites, trona** (soda ash), **diatomite, natural carbon dioxide, kunkar** and **gypsum**. Gem quality **rubies** have recently been discovered.

Carbonatites are known to be host of several minerals found in the Nyanzian shield area, around Lake Victoria shores and in the southern part of the coastal sedimentary basin. Mrima, one of the carbonatites known for potential of **niobium** and **rare earth elements** (REE) is found in the coastal basin, south of Mombasa.