

Pegmatites of Malilongue, Mozambique

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INTRODUCTION

Malilongue , spelled phonetically as Marlilongwe is a geologically significant area and mineral exploration site located in the northwest Tete province of Mozambique. The region is primarily known in global industries for its mineral potential, particularly its heavy rare elements HREE, lithium, tantalum, and tin deposits. Long before international commercial exploration took place, the area was known locally for its artisanal pegmatite working and small-scale mining. Beryl, topaz and amazonite are the main gemstones mined in local pegmatites.

In this paper we study the gemmological properties of local beryl, found in different colours, from dark blue, African Santa maria, to light blue, the green and yellow beryl. The morphology of crystals is also described.



Figure 1: Prismatic habitus of Malilongue beryl cristal

GEOGRAPHY

The Malilongue granite body is in western part of Mozambique, in Tete Province. The nearest small town is Fingoe and the mine site is 45 km west of Fingoe. The area is halfway between lake Cahora Bassa on the Zambezi River and the Zambia border.

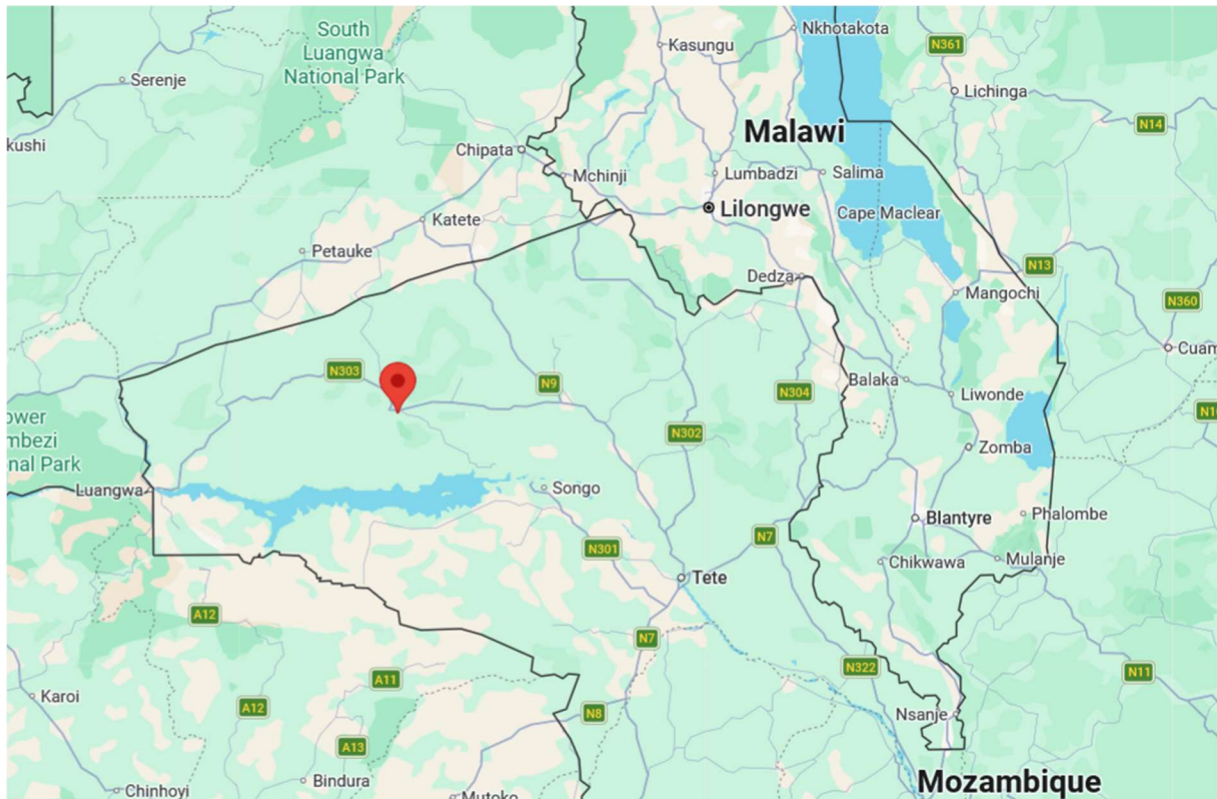


Figure 2 : geographical position of Malilongue pegmatite

GEOLOGY

The area features the Malilongue granite and multiple pegmatite geological formations, making it highly prospective for rare mineral exploration. Two important magmatic bodies with pegmatites are in Mozambique : Alto Ligonha on the north eastern side and Malilongue in the Province of Tete.

Alto Ligonha

The pegmatites here form massive, internally complex, well-zoned sheets and lenses up to 400 meters in diameter. Because they were emplaced in high-grade metamorphic schists and gneisses during regional thrusting, they underwent an extraordinarily high degree of chemical differentiation, concentrating exotic elements like copper, bismuth, and lithium into dense, gemstone-rich pocket zones.

Malilongue (Tete)

Formed within the ancient Precambrian crystalline and metamorphic basement framework of southern Africa. The mineralization here is tightly constrained by the cooling signature of the parent **Malilongue Granite** pluton. Volatile-rich elements did not migrate far into the

surrounding country rock, clustering instead along fractures immediately tracing the granite's perimeter. This makes exploration highly predictable but limits individual pegmatite deposits to smaller, linear dimensions compared to the giant fields of the north.

Malilongue is close to Zimbabwe craton and the Tete geology formation.

Alto Ligonha is dominated by Namana trust belt Meso, Neoproterozoic bloc of Nampula.

Alto Ligonha covers a very large territory about 200 km of diameter, with thousands of very strongly fractured pegmatite outcrops. Malilongue granite is a small plutonic body about 20 km of diameter with several pegmatites on its extremity, mainly on eastern side of granitic body.



Figure 3 : Malilongue Project location map

<https://announcements.asx.com.au/asxpdf/20120217/pdf/424dzk5nvnhr8b.pdf>

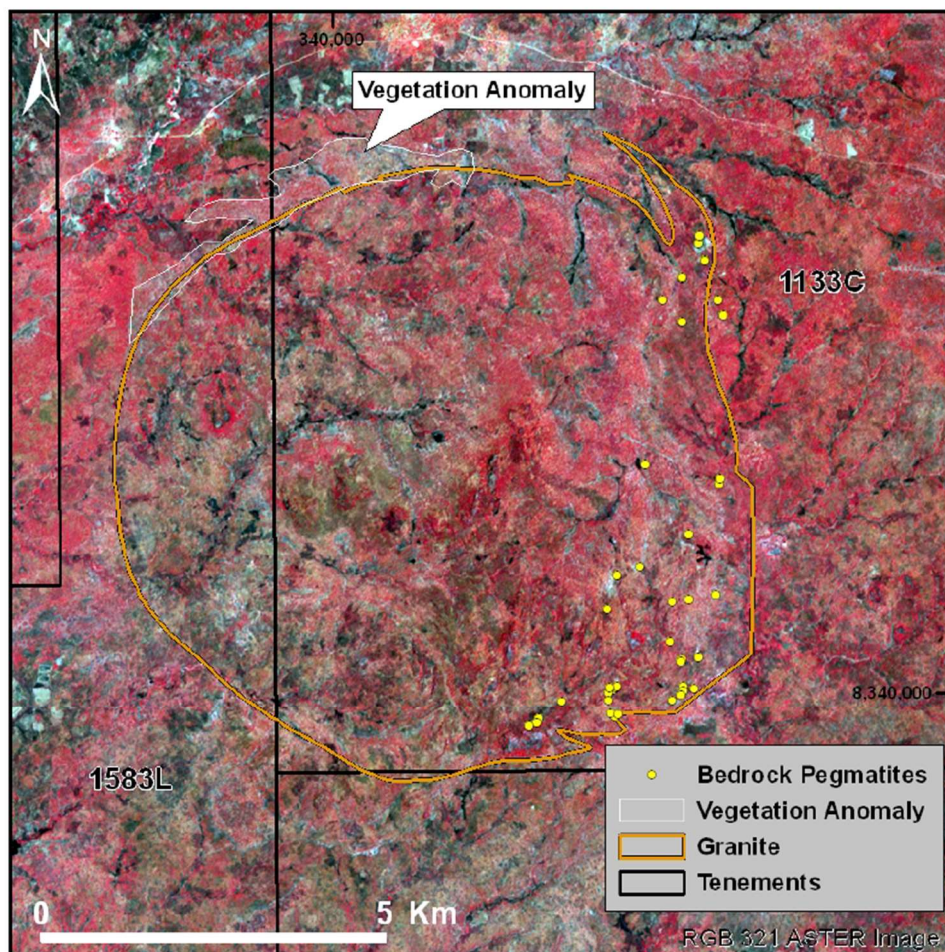


Figure 4: ASTER image (RGB 321) of the Malilongue granite demonstrating the vegetation cover (red colouration) and showing the strong northern vegetation anomaly.

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MINERALISATION

Both deposits are the sources of heavy rare minerals in association with pegmatites HREE. LCT pegmatites, they contain lithium, cesium, tantalum. With strict mineral zoning in Alto Ligonha. Malilongue pegmatites with standard fractionation, closely tracking granite, contact metamorphic aureoles.

The key lithium minerals are abundant spodumene, lepidolite, petalite and amblygonite in Alto Ligonha. Lepidolite and spodumene are dominant in Malilongue.

In tantabium nionbium yield , massive producer of columbite and tantalite in Alto Ligonha. Artisanal mining of tantalum and tin in Malilongue .

The signature gemstones are very high value Paraiba, cooper bearing tourmaline, multicolored elbaite and massive beryl in Alto Ligonha. Amazonite, topaz and beryl is dominating in Malilongue.

Alto Ligonha is industrialised since 1920, there is the largest historical pegmatite pit in the country. Malilongue is only artisanal workings with garimpeiros, recently greenfield exploration programs were starting.



Figure 5: Chigaio pegmatite exposed in artisanal working showing very coarse green amazonite
<https://announcements.asx.com.au/asxpdf/20120217/pdf/424dzk5nvnhr8b.pdf>

ARTISANAL MINING HISTORY

It is the subject of historical industrial interest regarding pegmatite rights and rare earth elements, alongside the artisanal collection of gem-quality specimens.

Long before international commercial exploration took place, the area was known locally for its artisanal pegmatite working and small-scale mining.

The specimens were mined about 20 years ago with the small-scale local mining licence 1133, belonging to Great Western Mining Ltd. Good quantities of large gem topaz crystals, brilliant green very large amazonite crystals, pink and green gem tourmaline, various colours of gem quality beryl, blue, green, golden, some gem crystals being 12x3 inches in size. Amethyst and rose quartz were common. All these gems plus tin, tantalite, niobium and rare earth elements were found in the many pegmatites scattered throughout the geological feature known as Marlilongwe Granite intrusion, a roughly circular feature approximately 20 km in diameter.



Figure 6: Artisanal workers extracting gemstones from the Chigaio pegmatite.
<https://announcements.asx.com.au/asxpdf/20120217/pdf/424dzk5nvnhr8b.pdf>

CRISTAL HABITUS OF BERYL

The beryl crystals exhibit a prismatic habit and are often doubly terminated, displaying striking growth features. They are large; the maximum size observed in this collection is 4 x 3 x 2 cm. Specimen colors range from light to dark blue, as well as green and yellow. The crystals feature a prismatic habit defined by hexagonal prisms and basal pinacoids. Deep growth markings are visible on the crystal surfaces: rectangular patterns on the prism faces and hexagonal patterns on the basal pinacoid.



Figure 7 : Prismatic habitus of beryl crystals from Malilongue pegmatite.

SURFACE MARKINGS



Figure 8 : rectangular depressions on the prismatic faces of beryl

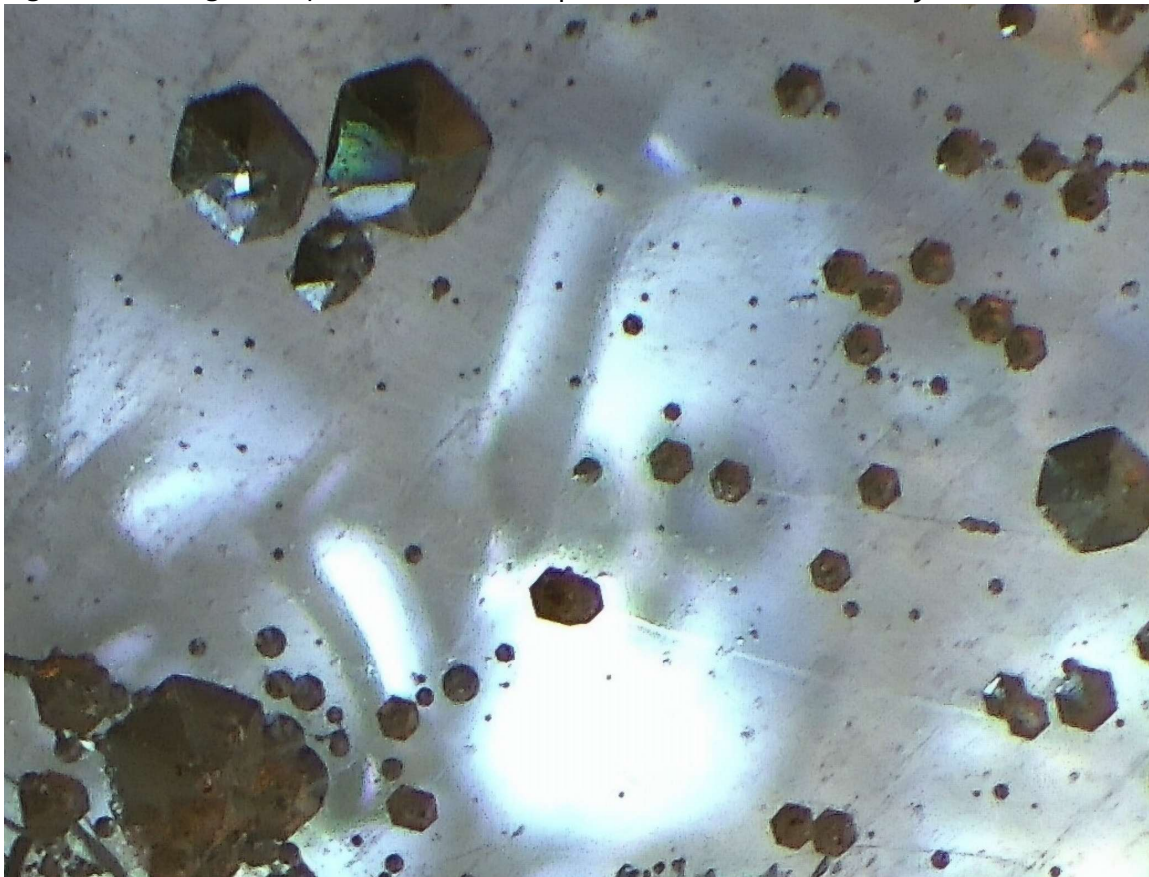


Figure 9 : hexagonal depression markings on the basal pinacoid of beryl

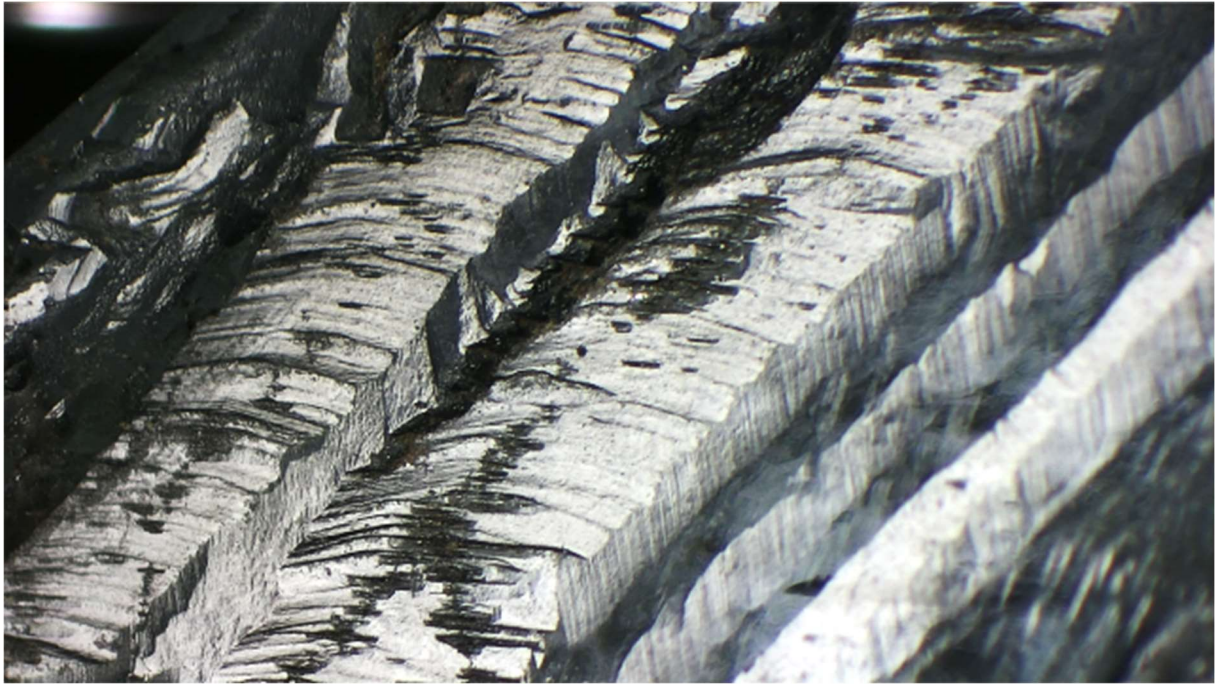


Figure 10 : surface markings along the c axis of beryl cristal, dislocations, striations

INCLUSIONS

Most of crystals are free of inclusions. Etch marks are on some specimens very deep. Fluids are mostly present, ilmenite in some specimens.

PLEOCHROISM

Pleochroism is very pronounced—shifting from dark blue to colorless—a variety often referred to as "Santa Maria Africana." It is never heated. The most striking feature is unusually strong dichroism, displaying deep blue and pale bluish green colours (figure 11). Such strong dichroism was reminiscent of Maxixe-type (irradiated) beryl, although their dichroic colours are usually deep blue and colourless. The deep saturated blue was seen along the e-ray, the pale bluish yellow along the o-ray. Such a pattern of colour absorption is associated with aquamarine; the opposite effect occurs in Maxixe-type beryl, which appears colourless along the e-ray and deep blue along the o-ray.



Figure 11 : Pleochroic colours of beryl of Malillogue

UV VIS SPECTROSCOPY

Further analysis was performed with UV-Vis-NIR spectroscopy to confirm the cause of color and differentiate between aquamarine and Maxixe-type beryl.

Ultraviolet-Visible-Near Infrared (UV-Vis-NIR) spectroscopy for **aquamarine** (*aigue-marine*) identifies structural iron chromophores within the beryl crystal matrix. Polarized UV-Vis spectra display distinct absorption bands governed by Fe^{2+} and Fe^{3+} ions, confirming natural coloration, origin, and heat-treatment status.

370 nm & 427 nm bands: Associated with Fe^{3+} electronic transitions, contributing yellow hues.

620–700 nm broad band: Associated with Fe^{2+} , enhancing the deep blue colour component.

810 nm band (often blue-shifted to ~760 nm): Caused by Fe^{2+} transitions that alter green-to-blue pleochroic ratios <https://www.gia.edu/gems-gemology/fall-2014-gemnews-aquamarine-dichroism>

Polarized spectra (figure) revealed an absorption peak at approximately **427 nm** along the o- and e-rays, a typical feature in aquamarine due to the presence of ferric iron; an additional peak at about **370 nm** also occurred along the o-ray. No features associated with radiation-induced color centers were present between 500 and 700 nm; these are typically observed in Maxixe-type beryls.

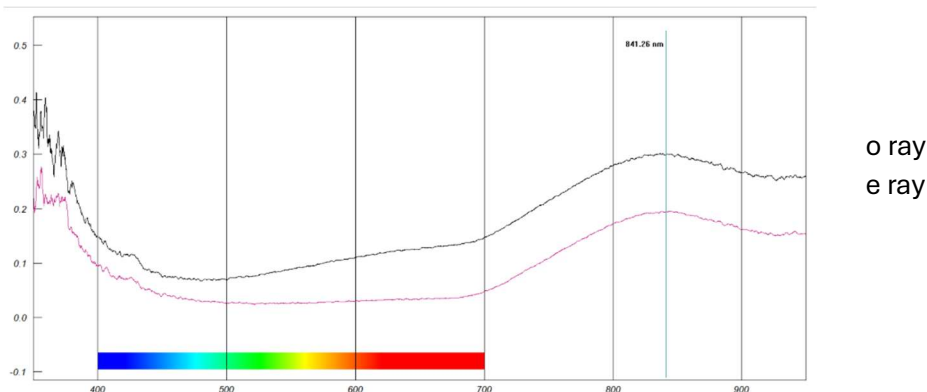


Figure 12 : absorption of o and e ray in Malillogue beryl, 370nm, 427nm, 820 nm

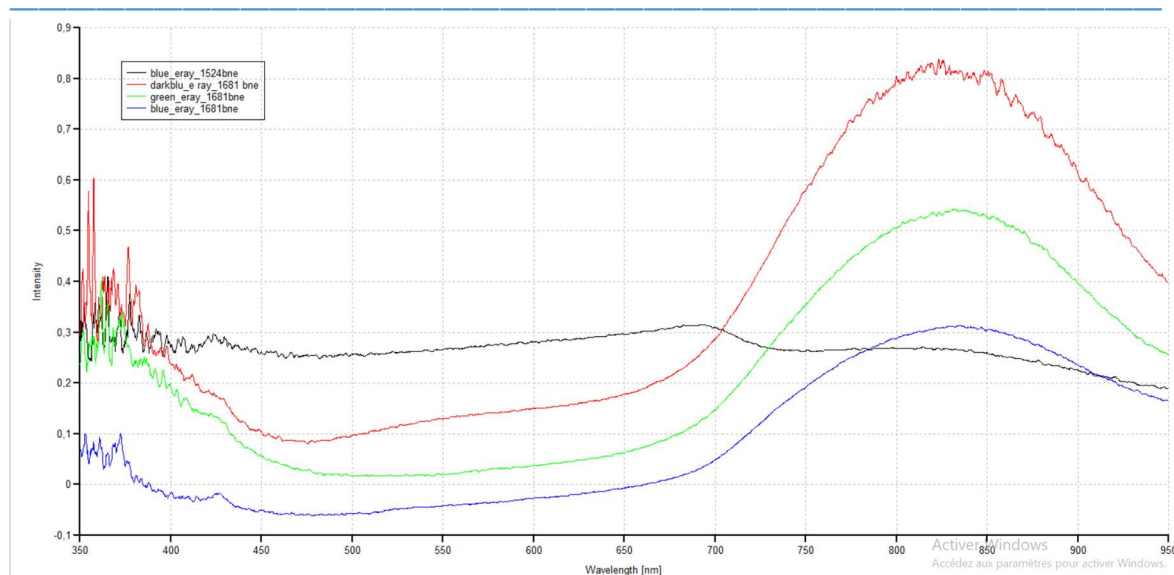


Figure 13 : e ray absorption of different colours from dark blue to light blue beryl from Malilongue, 370 nm, 427 nm of Fe³⁺, and 820 nm of Fe²⁺. Absorption around 700 nm in one specimen.

MARKET RARITY

Unlike those from the Alto Ligonha region, aquamarines from Marilongue are even more rare and rarely appear on the market on a regular basis. They surface sporadically when collections specializing in East African minerals are dispersed.

VALUE ESTIMATE

Due to an origin that is atypical for beryl collectors, an aesthetic, well-terminated Marilongue crystal (ranging from miniature to cabinet size) generally sells for ****between 1,500 and 3,500**** on platforms specializing in exceptional minerals, with the value driven by the "rare locality" factor.

NEW MINING LAW IN 2026

Évolution législative (2026) : Le gouvernement mozambicain a promulgué une nouvelle loi minière qui impose une participation gratuite de 15 % de l'État dans tous les projets miniers et interdit l'exportation de minerais bruts non transformés. Tout futur développement commercial à Malilongue devra inclure un plan de traitement local. [1]

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