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RESEARCH ARTICLE

PETROGRAPHY AND GEOCHEMISTRY OF GUIGLO GNEISSES, CÔTE D'IVOIRE

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Abstract

Aims: This study investigates the petrographic, mineralogical, and geochemical characteristics of two representative lithotypes from the Guiglo area in southwestern Côte d'Ivoire: a migmatitic gneiss (NZO-1) and an amphibole-bearing augen gneiss (GUI-1), to constrain their petrogenesis and tectonic significance within the Palaeoproterozoic evolution of the West African Craton.
Methodology: Field structural measurements, optical microscopy, electron microprobe mineral analyses, and whole-rock major and trace element geochemistry were employed. Mineral compositions were determined using a CAMECA SX100 electron microprobe at Ifremer, France. Major elements were analyzed by XRF and trace elements by ICP-MS at ACTLABS, Canada.
Results: The NZO-1 migmatite exhibits a granodioritic to trondhjemitic composition (SiO_2 = 68.7 wt%; Na_2O+K_2O = 6.33%; A/CNK = 0.60), with calcic amphiboles (ferropargasite and actinolite), augite, albite, quartz, sphene, and epidote. The GUI-1 augen gneiss is monzodioritic to tonalitic (SiO_2 = 52.9 wt%; MgO = 4.3%; A/CNK = 0.79), with green hornblende, orthoclase, plagioclase, biotite, and sphene. Both rocks record sinistral shear (N166° and N150° trends) and exhibit subduction-related geochemical signatures characterized by LILE enrichment and Nb-Ta depletion.
Conclusion: This work provides the first integrated petro-structural and geochemical dataset for these gneisses from the Guiglo area, highlighting their trondhjemitic lineage and dual tholeiitic (NZO-1) versus calc - alkaline (GUI - 1) affinities. These results contribute significantly to understanding Palaeoproterozoic crustal evolution in the southwestern West African Craton, indicating reworking of Paleoarchean crustal components during the Eburnean orogeny.

Introduction:-

The West African Craton (WAC) constitutes one of the largest and best-exposed Palaeoproterozoic terrains on Earth, comprising extensive greenstone belts, granitoid-gneiss complexes, and sedimentary basins [1, 2]. In Côte d'Ivoire, the Birimian formations (ca. 2.2–2.0 Ga) are subdivided into several domains, among which the Man

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domain and the SASCA (Sassandra–Cavally) domain represent key geological entities [3, 4]. The Man domain, which includes the Guiglo area, is characterized by Archean to Palaeoproterozoic crustal segments with a strong archaic signature [5, 6, 7].

The Guiglo area, situated in southwestern Côte d'Ivoire, lies at the transition between these two domains, within the Man domain but in close proximity to the SASCA domain. Despite its regional importance, the gneissic rocks of this area have received limited attention compared to the more prolific greenstone belts of the Baoulé-Mossi domain. Key questions remain unresolved regarding the protoliths, magmatic affinities, metamorphic conditions, deformation regimes, and tectonic significance of these rocks.

To address these questions, we selected two representative outcrops exposed along the N'zo River in the vicinity of Guiglo: the migmatitic gneiss NZO-1 and the amphibole augen gneiss GUI-1. We combine field structural data, detailed mineral chemistry, and whole-rock geochemistry to constrain their petrogenesis, metamorphic evolution, and tectonic significance. Our results provide new insights into the crustal architecture and geodynamic evolution of the southwestern WAC during the Palaeoproterozoic.

Geological Setting and Field Observations:-

Regional Geology of the Guiglo Area:-

The Guiglo area is located in southwestern Côte d'Ivoire, within the Man domain of the West African Craton (Figure 1). The Man domain is characterized by Archean to Palaeoproterozoic crustal segments with a strong archaic signature [5, 6, 7,8] (Figure 2).

The region forms part of the PalaeoproterozoicBirimian terranes, which are characterized by three main lithological associations [1, 2]:-

- The Lower Birimian (ca. 2.2–2.15 Ga): Consists of volcanic and volcano-sedimentary sequences including basalts, andesites, rhyolites, greywackes, and cherts, metamorphosed to greenschist to amphibolite facies [1, 2].
- The Upper Birimian (ca. 2.1–2.05 Ga): Comprises sedimentary basins dominated by shales and turbidites, intruded by granitoids of various compositions [1, 2].
- The Eburnean Orogeny (ca. 2.1–2.0 Ga): Characterized by polyphase deformation, high-grade metamorphism, and extensive crustal reworking [1, 2, 9].

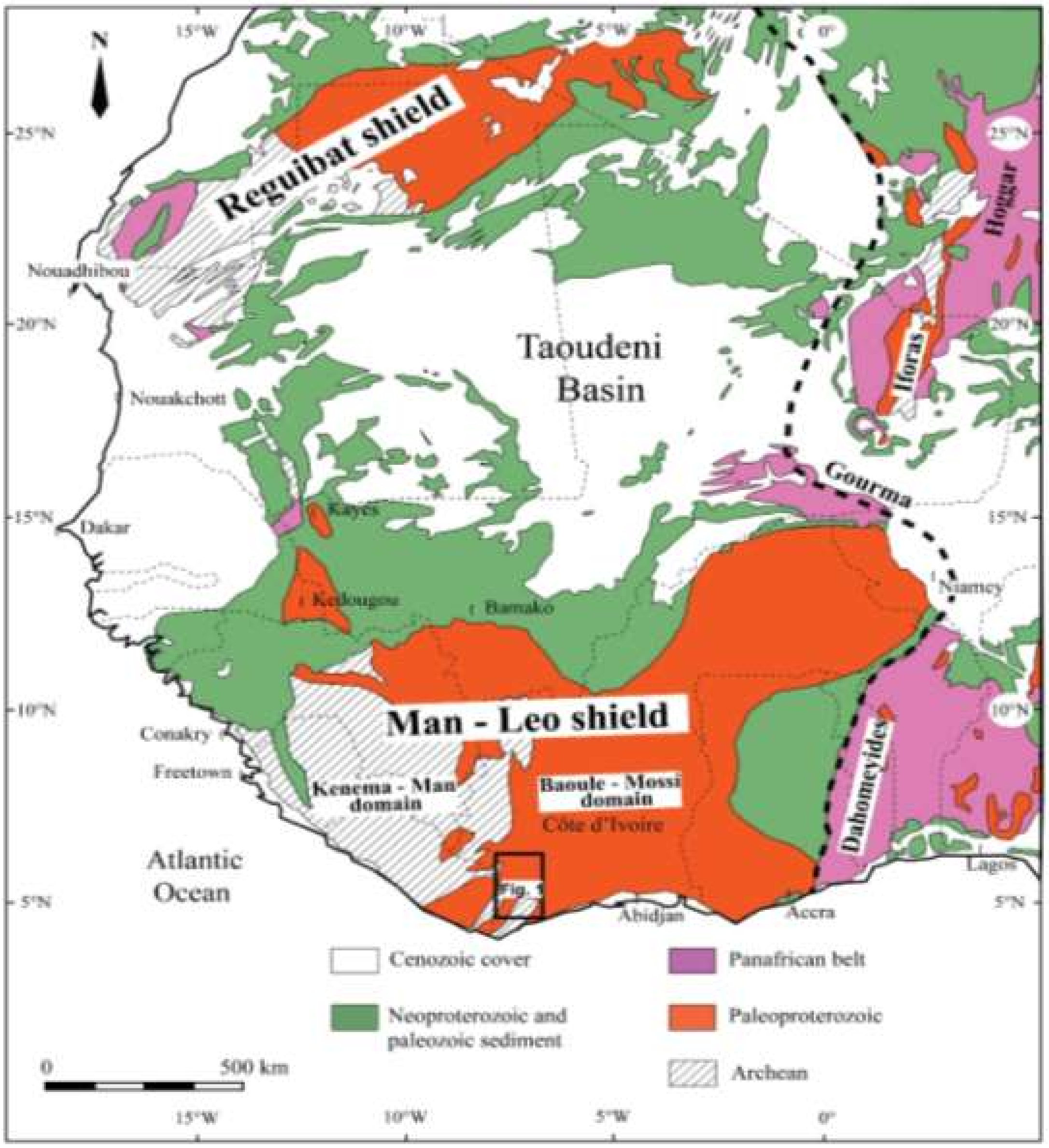

Figure 1: Geological sketch map of the West African Craton, . (Modified from [5, 6, 7])

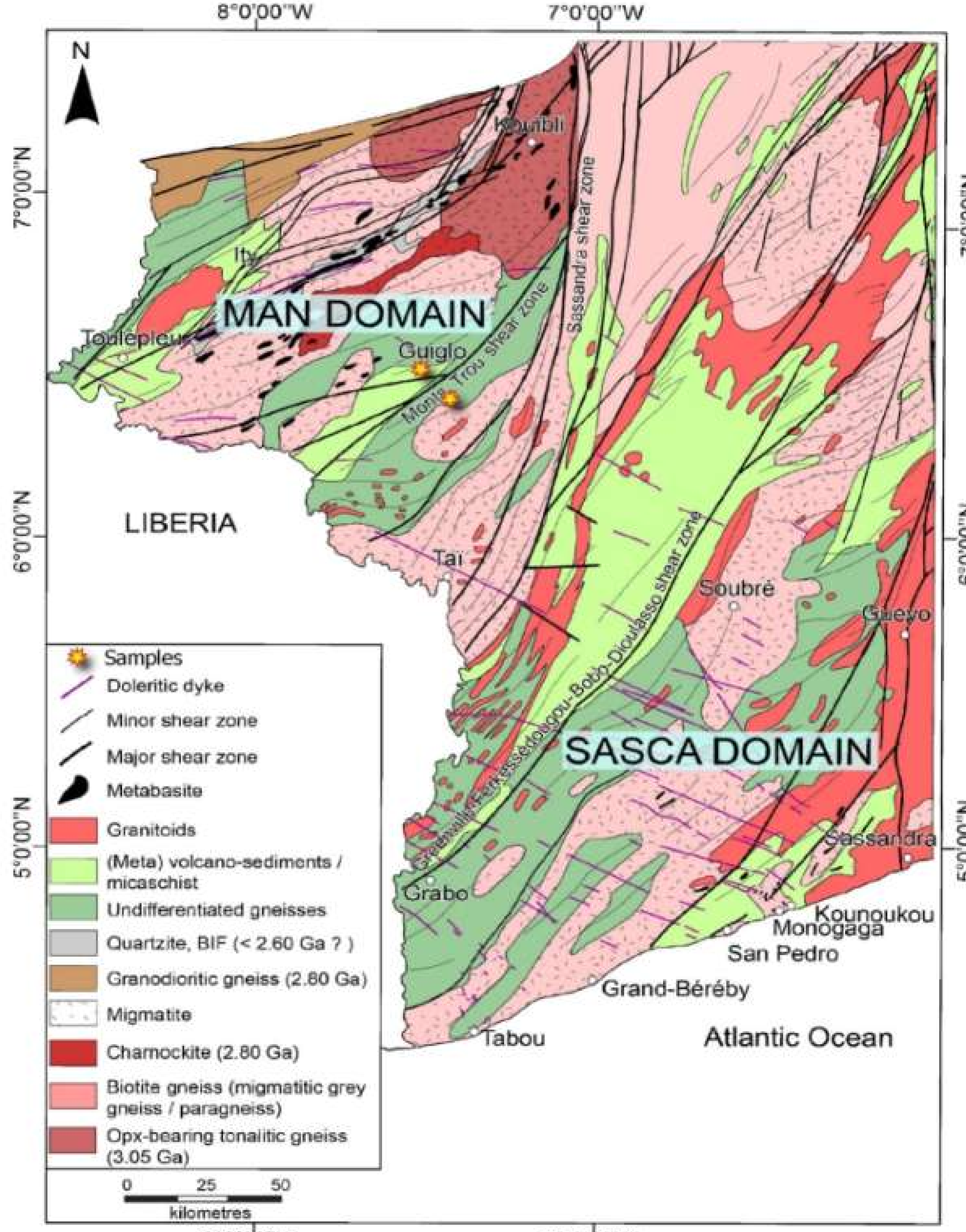

Figure 2: Simplified geological map of southwestern Côte d'Ivoire showing the location of the Guiglo area within the Man domain of the West African Craton. The map highlights the transition zone between the Man domain and the SASCA (Sassandra-Cavally) domain. The locations of the NZO-1 and GUI-1 sampling sites along the N'zo River are indicated. (Modified from [3, 4])

Field Observations:-

NZO-1 Migmatitic Gneiss:-

The migmatitic gneiss NZO-1 is exposed along the bed of the N'zo River, where low water levels allowed detailed observation of this typically submerged outcrop (Figure 3).

It exhibits:-

- A well-developed migmatitic texture with quartzo-feldspathic veins
- Foliation striking N42°–N30° and dipping 42° NE
- Sinistral faults trending N166° filled with mafic material
- Readily visible magnetite flakes throughout the rock

GUI-1 Amphibole Augen Gneiss:-

The amphibole augen gneiss GUI-1 outcrops at the Catholic Church guesthouse along the N'zo River in Guiglo (Figure 4).

It displays:-

- A characteristic augen texture with potassium feldspar megacrysts
- Sinistralshearindicators
- A subhorizontal foliation striking N150°
- Fractures trending N130°

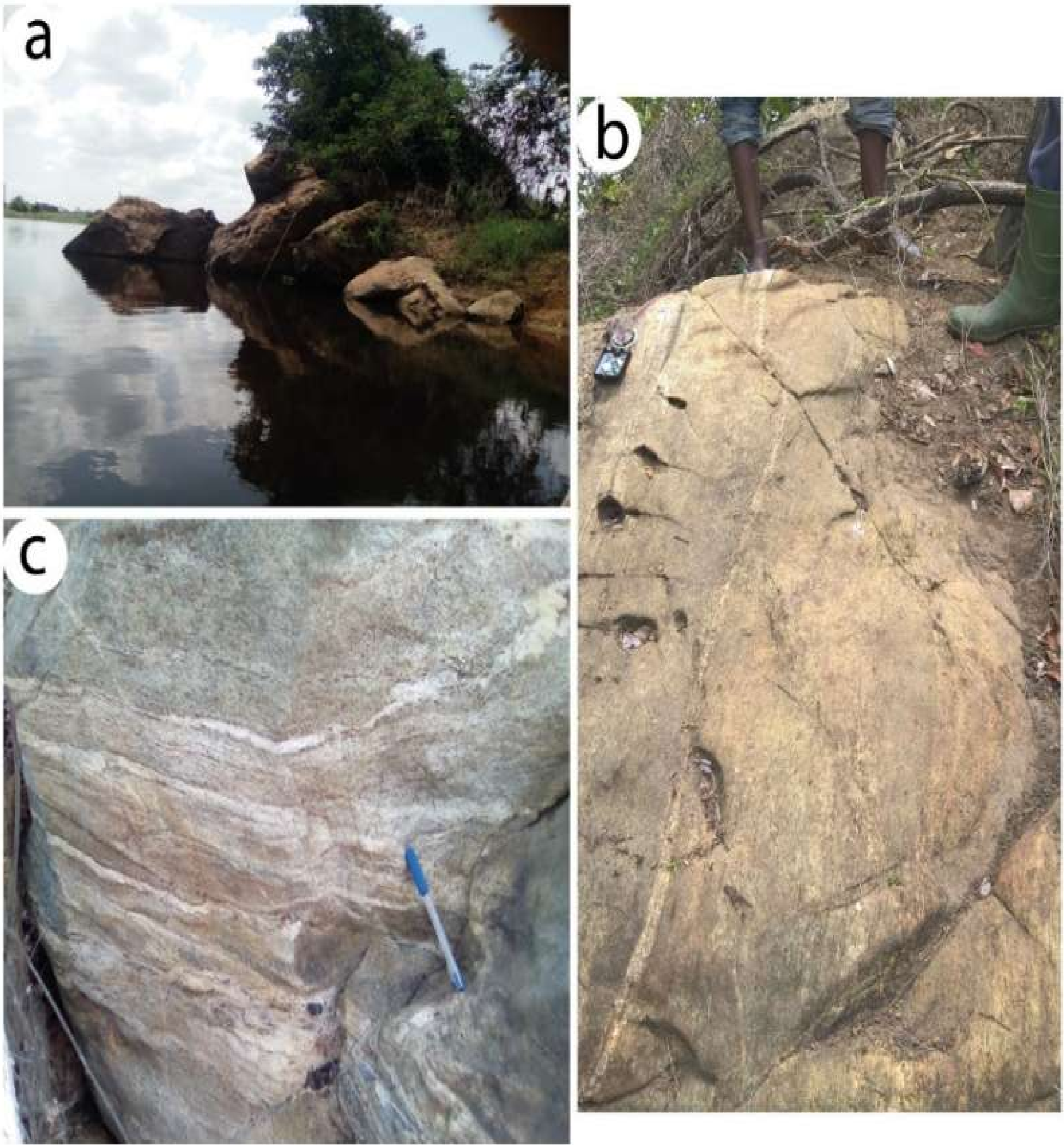

Figure 3: Field photographs of the NZO-1 migmatitic gneiss exposed along the bed of the N'zo River. (a) General view of the outcrop showing the migmatitic texture with quartzo-feldspathic veins. (b) Detailed view showing foliation (striking N42°–N30°, dipping 42° NE) and sinistral faults trending N166° filled with mafic material. (c) Close-up showing readily visible magnetite flakes.

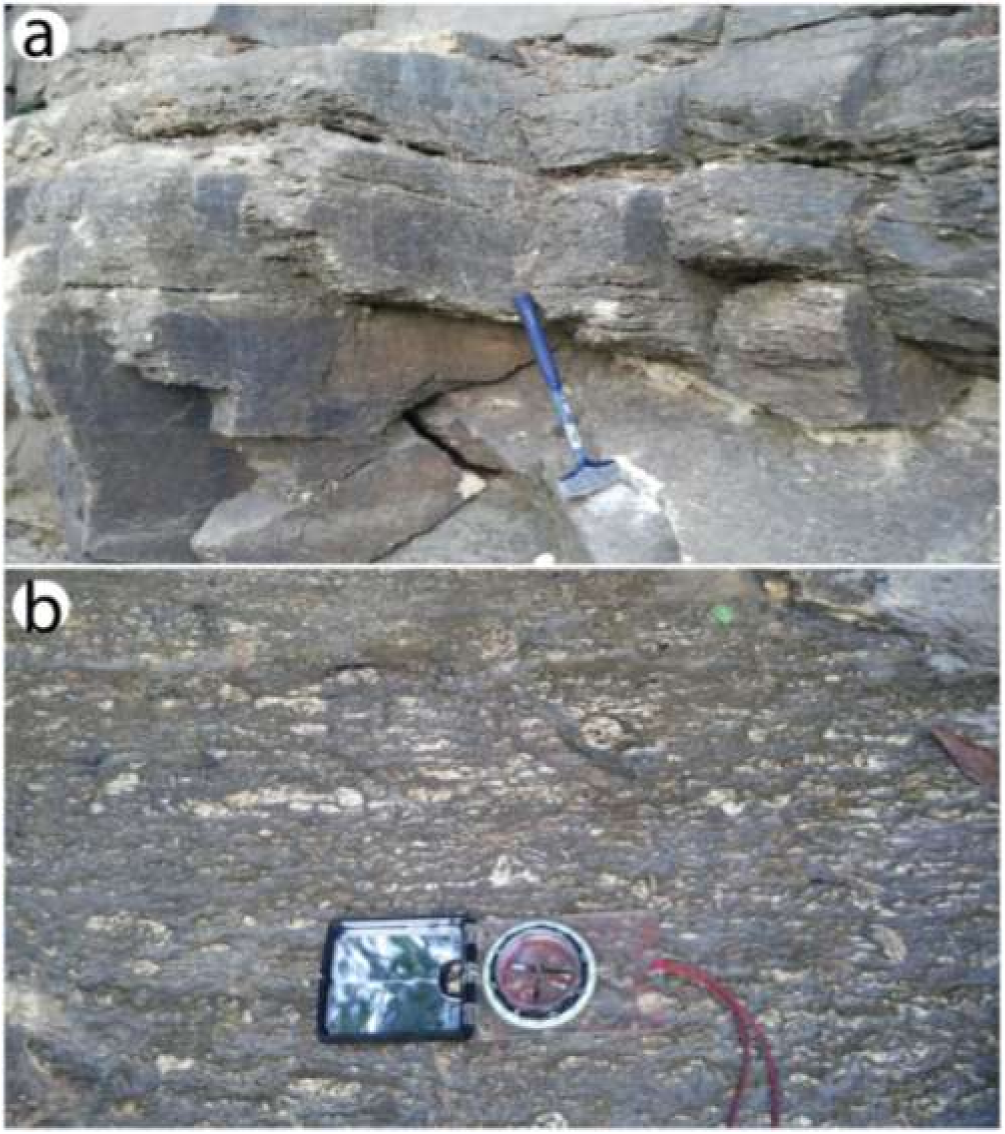

Figure 4: Field photographs of the GUI-1 amphibole augen gneiss outcropping at the Catholic Church guesthouse along the N'zo River. (a) General view showing the characteristic augen texture with potassium feldspar megacrysts. (b) Detailed view showing subhorizontal foliation striking N150° and fractures trending N130°.

Materials and Methods:-

Sampling and Sample Preparation:-

Representative blocks (approximately 5 kg each) were collected from fresh outcrops for subsequent petrographic and geochemical analyses. Thin sections, including polished sections, were prepared at the Geosciences Rennes thin section laboratory, University of Rennes 1. Standard petrographic thin sections (30 µm thickness) were prepared for optical microscopy examination. The polished sections were prepared with a final polish using 0.25 µm diamond paste to obtain a high-quality surface finish suitable for electron microprobe analysis.

Optical Microscopy:-

Petrographic observations and modal estimations were performed using a Leica DM2500P polarizing microscope equipped with a digital camera. Mineral abbreviations follow Whitney and Evans [10].

Electron Microprobe Analysis:-
Mineral compositions were determined using a CAMECA SX100 electron microprobe equipped with wavelength-dispersive spectrometry (WDS) at the Ifremer facility in Brest, France.

The analyses wereperformedunder the following operating conditions:-
- Acceleratingvoltage : 15 kV
- Beam current: 10 nA
- Focusedbeamdiameter: 1–5 µm

Calibration was carried out using both natural and synthetic standards. The raw data were reduced using the PAP matrix correction procedure [11]. Mineral identification and nomenclature followed the classifications of Leake et al. [12] for amphiboles and Morimoto [13] for pyroxenes.

Whole-Rock Geochemistry:-
Large samples (5 to 10 kg) were crushed following a standard protocol to obtain adequate powder fractions using agate mortars. Chemical analyses were performed by the Service d'Analyse des Roches et des Minéraux (SARM; CRPG-CNRS, Nancy, France) using a ICP-AES for major-elements and a ICP-MS for trace-elements following the tech-niques described in Carignan et al. (2001) [14]. Data normalization to primitive mantle followed Sun and McDonough [15].

Results:-

Petrography and Mineral Chemistry:-

Migmatitic Gneiss NZO-1:-
The NZO-1 migmatite exhibits a heterogranular texture, with dark (mafic) and light (felsic) minerals that define a crude, slightly indistinct foliation (Figure 5a, b). The grain size is medium to coarse, ranging from 0.6 to 9.6 mm in diameter. Amphibole represents approximately 30% of the rock volume and forms xenomorphic crystals ranging from 0.6 to 2.4 mm in size. These amphiboles are pale green in color and weakly pleochroic, characteristic of calcic amphiboles.

Chemical analyses reveal:-
- Calcium contents: 1.88 to 1.98 pfu (per formula unit)
- Sodium : 0.083 to 0.66 pfu
- Potassium : 0.012 to 0.18 pfu
- $(Na+K)_a$values : 0.09 to 0.64 pfu

Based on the classification of Leake et al. [11], two distinct types of amphiboles have been identified:-
1. Ferropargasite: XFe values of 0.52–0.59; XMg values of 0.41–0.48
2. Actinolite: XFe of 0.33; XMg of 0.67; silicon contents of 7.77 pfu

Clinopyroxene is less abundant than amphiboles and crystallizes as subhedral sections similar in size to the average grain size.

All clinopyroxenes are classified as augite with:-
- Al_2O_3 contents: 1.16 to 1.81 wt%
- XFevalues : 0.30 to 0.34

Quartz represents about 20% of the rock and occurs as small grains less than 1.2 mm in size.Plagioclase ranges from 3.2 to 9.6 mm and represents approximately 20–30% of the rock. It is sometimes altered, showing evidence of sericitization and saussuritization, and is essentially represented by albite with Xab values ranging from 0.85 to 0.98. Sphene is present as large crystals up to 4.8 mm in size and constitutes a characteristic accessory mineral with an estimated modal proportion of about 5%.Epidote occurs as clusters around opaque minerals, as small crystals, or as inclusions within plagioclase. Microfractures are also filled with epidote.
Apatite and zircon are present as accessory phases.

Amphibole Augen Gneiss GUI-1:-

The GUI-1 gneiss displays a heterogranular texture, with large crystals of amphibole and orthoclase set within a finer-grained matrix (Figure 5c, d). The orthoclase crystals are associated with quartz and together form augen structures characteristic of this rock type.Amphibole (green hornblende) represents approximately 30% of the rock and forms large, elongated domains ranging from 4.8 to 9.6 mm in size.Biotite is brown in color and occurs as needles or small lamellae sometimes found within the felsic bands or underlining the foliation together with amphiboles in the mafic bands.Quartz, orthoclase, and plagioclase together represent approximately 30% of the rock and constitute the clear bands exhibiting a granoblastic texture. Grain size ranges from fine to coarse, with some grains reaching up to 28.8 mm in diameter.Sphene forms subhedral aggregates aligned with the amphiboles, suggesting syntectonic growth during the main deformation event.

Epidote occurs as clusters, while apatite and zircon are present as accessory phases.

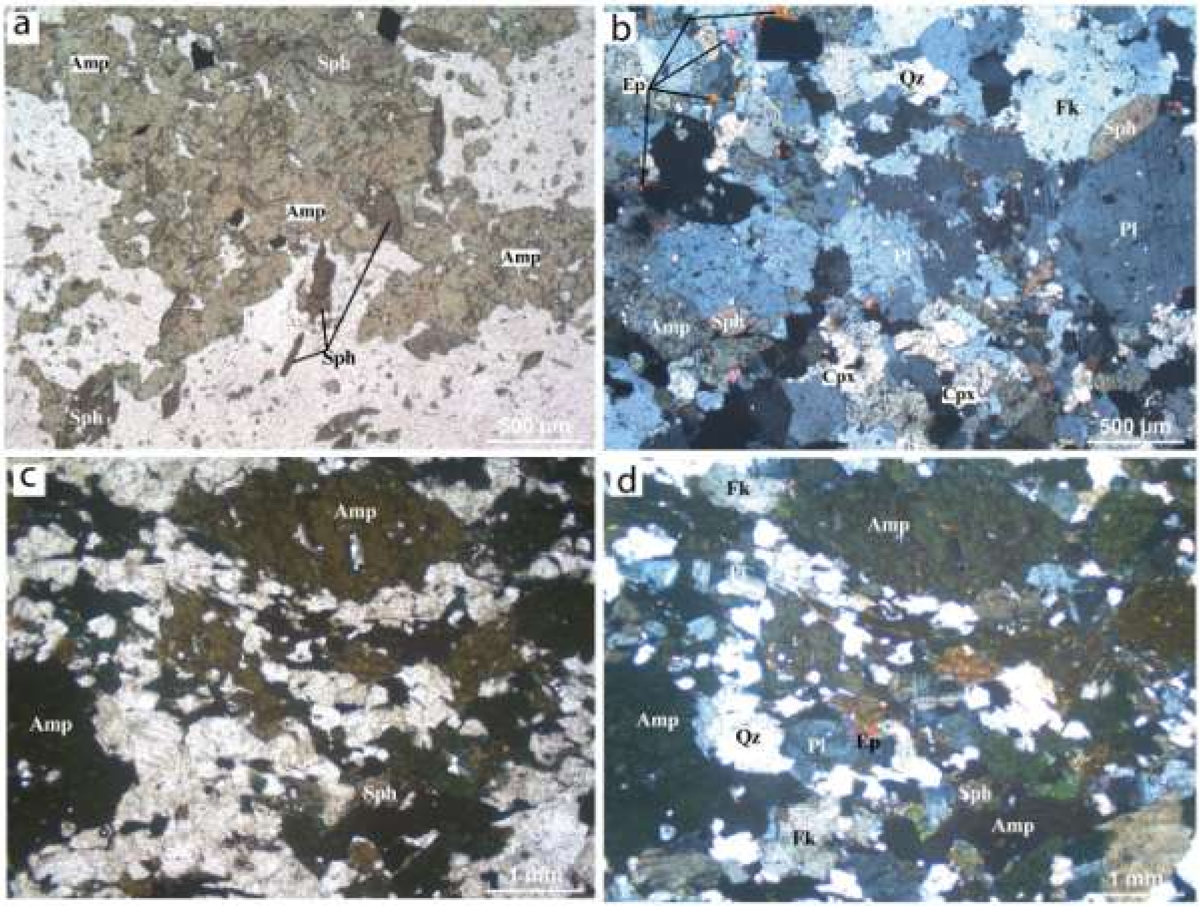

Figure 5: Photomicrographs showing the microscopic aspects of the studied rocks (crossed-polarized light unless otherwise specified). (a) NZO-1 migmatitic gneiss showing heterogranular texture with calcic amphibole (ferropargasite) and quartz. (b) NZO-1 migmatitic gneiss showing augite crystals with albite and sphene. (c) GUI-1 amphibole augen gneiss showing large hornblende crystals with orthoclase and quartz forming augen structures. (d) GUI-1 amphibole augen gneiss showing sphene aggregates aligned with amphiboles, suggesting syntectonic growth. Mineral abbreviations: Am = amphibole; Qtz = quartz; Fk = K-feldspar; Bi = biotite; Cpx = clinopyroxene; Pl = plagioclase; Ep = epidote; Sph = sphene; Ab = albite; Hbl = hornblende.

Whole-Rock Geochemistry:-

Major Elements:-

The major element compositions of the two studied rocks are presented in Table 1.

The NZO-1 migmatite contains:-
- SiO_2: 68.7 wt%
- Total alkalis (Na_2O+K_2O): 6.33%
- TiO_2: 0.47%
- MgO: 1.6%

In the TAS diagram [16], this rock plots in the granodiorite field (Table 3). It is classified as trondhjemitic in the diagram of Barker [15] and follows a trondhjemitic trend in the Qtz-Ab-Or diagram [17]. The rock is strongly metaluminous with an A/CNK ratio of 0.60 and falls within the high-K tholeiitic series in the K_2O versus SiO_2 diagram.

The GUI-1 augen gneiss contains:-
- SiO_2: 52.9 wt%
- Total alkalis (Na_2O+K_2O): 6.16%
- TiO_2: 0.74%
- MgO: 4.3%

In the TAS diagram [17], this rock plots in the monzodiorite field (Table 3). It is classified as a tonalite in the diagram of Barker [16] and follows a trondhjemitic trend in the K-Na-Ca diagram [18]. It does not appear in the Qtz-Ab-Or diagram due to the absence of quartz. This rock is also strongly metaluminous with an A/CNK ratio of 0.79 and plots within the medium-K calc-alkaline series in the K_2O versus SiO_2 diagram.

Multi-Element Spectra:-
Trace element compositions are presented in Table 2.The primitive mantle-normalized multi-element spectra for both rocks are shown in Figure 6a.

Both samples display:-
- Enrichment in large ion lithophile elements (LILE) such as Rb, Ba, and K
- Relative depletion in high field strength elements (HFSE)
- Strong negative Nb-Ta anomalies (Nb/Nb* ratios of approximately 0.3–0.5)
- Depletion in Ti relative to neighboring elements
- Moderate enrichment of light rare earth elements over heavy rare earth elements (La/Yb_n ratios of about 8–10 for NZO-1 and 5–6 for GUI-1; Figure 6b)

These patterns are typical of subduction-related magmas, including arc basalts, andesites, and their differentiated equivalents.

Table 1: Major Element Composition

Oxide (wt%)	NZO-1 (Migmatite)	GUI-1 (Augen Gneiss)
SiO_2	68.7	52.9
TiO_2	0.47	0.74
Al_2O_3	14.2	16.3
Fe_2O_3(t)	4.8	8.9
MnO	0.09	0.15
MgO	1.6	4.3

Oxide (wt%)	NZO-1 (Migmatite)	GUI-1 (Augen Gneiss)
CaO	3.1	6.0
Na_2O	4.9	4.3
K_2O	1.43	1.86
P_2O_5	0.12	0.28
LOI	0.9	1.2
Total	**99.3**	**98.8**

Table 2: Trace Element Composition

Elements	NZO-1	GUI-1
Rb	47	68
Ba	520	410
Sr	310	480
Y	18	22
Zr	150	130
Nb	6	8
Ta	0.5	0.7
Th	5.2	3.8
U	1.1	1.4
La	25	18
Ce	48	35
Yb	1.8	2.2
Lu	0.3	0.4

Table 3: Geochemical Classification[16]

Parameter	NZO-1	GUI-1
TAS [14]	Granodiorite	Monzodiorite
Barker [15]	Trondhjemite	Tonalite
Qtz-Ab-Or [16]	Trondhjemitic trend	Not plotted (no Qtz mode)
K-Na-Ca [16]	Trondhjemitic	Trondhjemitic
A/CNK (molar)	0.60 (stronglymetaluminous)	0.79 (metaluminous)
K_2O vs. SiO_2	High-K tholeiiticseries	Medium-K calc-alkaline series

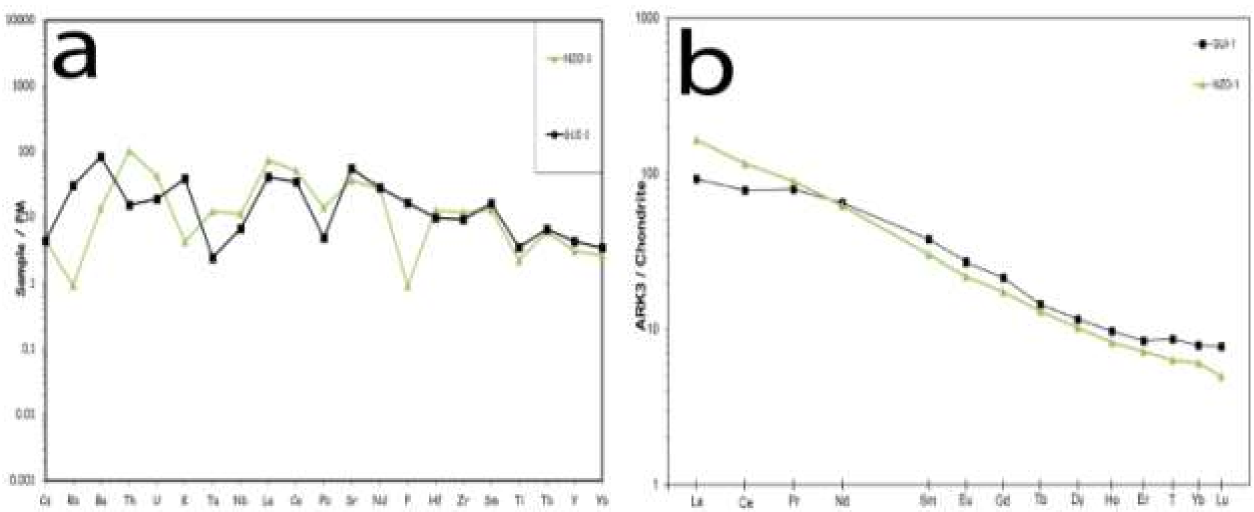

Figure 6: (a) Primitive mantle-normalized multi-element spectra for the studied rocks from the Guiglo area. (b)Chondrite-Normalized Rarefor the studied rocks from the Guiglo area

Discussion:-

Petrographic and Mineralogical Significance:-

The two studied rocks, although both belonging to the SASCA domain, exhibit distinct mineral parageneses reflecting different protoliths and metamorphic conditions.NZO-1 Migmatite: Characterized by a calcic amphibole (ferropargasite + actinolite) + clinopyroxene (augite) + albite + quartz + sphene ± epidote assemblage. The presence of relict augite, even in minor proportions, suggests an igneous protolith of basic to intermediate composition subsequently metamorphosed under amphibolite-facies conditions (T ≈ 550–650 °C, P ≈ 4–6 kbar). The coexistence of ferropargasite and actinolite indicates partial retrogression related to exhumation or infiltration of hydrous fluids under lower-temperature (greenschist-facies) conditions. The low potassium content in the amphiboles [$(Na+K)_a$ = 0.09–0.64 pfu] and their calcic chemistry are typical of active margin settings or lower crustal metabasic rocks.

GUI-1 Augen Gneiss: Richer in green hornblende, biotite, orthoclase, plagioclase, sphene, and epidote. The absence of clinopyroxene and presence of brown biotite indicate higher amphibolite-facies metamorphism (T ≈ 600–700 °C) with greater potassium and water activity. The coarse size of orthoclase and quartz crystals (up to 28.8 mm) and their arrangement into augen structures highlight syn-metamorphic ductile shearing with syntectonic growth of feldspars. Biotite, though minor, is aligned in dark bands with amphibole, indicating a penetrative foliation contemporaneous with deformation.

Geochemical Interpretation: Protolith Nature and Degree of Differentiation:-

The major and trace element compositions provide strong constraints on the source material and magmatic differentiation processes.NZO-1 Migmatite: Exhibits high SiO_2 (68.7 wt%), low MgO (1.6%) and TiO_2 (0.47%), and a high Na_2O/K_2O ratio, characteristic of trondhjemites. Its strongly metaluminous character (A/CNK = 0.60) excludes a pelitic sedimentary source and instead suggests an igneous protolith with low excess Al_2O_3, probably derived from partial melting of hydrated basaltic crust (amphibolite) in an arc or oceanic plateau setting. The Barker [16] diagram and Qtz-Ab-Or system both confirm a trondhjemitic lineage typical of Archaean and Palaeoproterozoic TTG magmas. Such magmas are generally produced by melting of subducted oceanic crust or thickened lower crust with a garnet + amphibole residue accounting for low HREE contents.

GUI-1 Augen Gneiss: More basic (SiO_2 = 52.9 wt%), more magnesian (MgO = 4.3%), and more titaniferous (TiO_2 = 0.74%). Its chemistry places it in the fields of monzodiorite (TAS) and tonalite (Barker). Its metaluminous nature (A/CNK = 0.79) is consistent with an enriched mantle source or a mixture of mantle-derived magmas and juvenile crust. The trondhjemitic trend in the K–Na–Ca diagram indicates that, despite its more basic composition, this gneiss has undergone fractional differentiation with sodium enrichment relative to potassium, typical of early calc-alkaline series.

Magmatic Affinities and Tectonic Setting:-

The primitive mantle-normalized multi-element spectra (Figure 6) show for both rocks:-

- Enrichment in LILE (Rb, Ba, K)
- Depletion in HFSE (Nb, Ta, Ti)
- Strong negative Nb–Ta anomalies

These signatures are characteristic of subduction-zone magmas, whether continental or island arcs, where LILE are mobilized by subduction fluids while HFSE are retained in the slab or residual mantle.

The assignment of:-

- NZO-1 to the high-K tholeiitic series
- GUI-1 to the medium-K calc-alkaline series suggests a complex magmatic evolution. High-K tholeiites can form by partial melting of metasomatized mantle at shallow depths or by differentiation of mantle-derived basalts in a back-arc extensional setting. Calc-alkaline series are typical of mature arcs where melting is triggered by hydration of the mantle wedge above the subducting slab.

This duality (tholeiitic versus calc-alkaline affinities) within the same domain may reflect either:-

- Temporal evolution (early tholeiitic stage followed by later calc-alkaline magmatism)
- Spatial heterogeneity (proximal versus distal arc zones)
- Greater crustal contamination for NZO-1 (high SiO_2, low MgO) versus more direct mantle contribution for GUI-1

Deformation and Metamorphism: Polyphase Record:-

Structural data indicate sinistral shearing (N166° for NZO-1; N150° for GUI-1) consistent with the transpressional Eburnean orogen [9]. The presence of epidote-filled microfractures and retrograde actinolite indicates polyphase metamorphism: peak amphibolite-facies followed by greenschist-facies retrogression during exhumation.

Recent structural studies on the Eburnean orogen have documented a bulk inhomogeneous transpressional flow regime, where deformation is accommodated through a self-similar anastomosed fabric–shear zone network converting crustal shortening into lateral and vertical escape [9, 19]. This flow pattern is pure-shear dominated and produces distributed crustal thickening combined with orogen-parallel escape, challenging traditional fault-driven escape tectonics models [9]. Orogen-scale transcurrent shear zones primarily act as transfer structures accommodating flow heterogeneities rather than plate-scale displacements [10].

Regional Correlations and Implications:-

The trondhjemitic and tonalitic compositions of these Guiglo rocks from the Man domain are comparable to those of the SASCA domain [4] and other Birimian terrains [21]. Their archaic signature [7] indicates that Paleoarchean crustal components were reworked during the Eburnean orogeny, consistent with the tectonic model involving crustal thickening, partial melting, and transcurrent shearing [4, 9].

The geochemical characteristics of both rocks support a model where:-

- Subduction-related magmatism generated both tholeiitic and calc-alkaline magmas
- These magmas underwent variable degrees of crustal contamination and fractional crystallization
- Subsequent amphibolite-facies metamorphism and deformation occurred during the Eburnean orogeny
- Final exhumation was accompanied by retrograde greenschist-facies metamorphism

Conclusion:-

This study demonstrates that the Guiglo area comprises two distinct gneissic lithotypes with significant implications for understanding Palaeoproterozoic crustal evolution in the southwestern West African Craton:-

- NZO-1 Migmatite:Atrondhjemitic migmatite containing calcic amphiboles (ferropargasite + actinolite) and augite, reflecting amphibolite-facies metamorphism with retrogression. Geochemically, it is a high-K tholeiitic trondhjemite with subduction-related signatures.
- GUI-1 Augen Gneiss: A tonalitic augen gneiss containing hornblende, biotite, and orthoclase, indicating upper amphibolite-facies conditions. Geochemically, it is a medium-K calc-alkaline tonalite with similar subduction-related signatures.
- Tectonic Significance: Both rocks exhibit LILE enrichment and Nb–Ta depletion typical of subduction-related magmas. Structural data record sinistral shearing (N166° and N150°) consistent with the transpressional Eburnean orogen.
- Crustal Evolution: The trondhjemitic and tonalitic compositions, combined with archaic signatures, indicate reworking of Paleoarchean crustal components during the Eburnean orogeny, contributing to the crustal architecture of the southwestern WAC.
- Future Research: Further geochronological studies (U-Pb zircon dating) and isotopic analyses (Nd, Hf) would help constrain the timing of magmatism and metamorphism, and better understand the source characteristics of these rocks.

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Disclosure of conflict of interest The authors declare no competing interests.

References:-

[1] Milesi, J.P., Ledru, P., Feybesse, J.L., Dommanget, A., & Marcoux, E. (1992). Early Proterozoic ore deposits and tectonics of the Birimian orogenic belt, West Africa. Precambrian Research, 58(1–4), 305–344.
[2] Feybesse, J.L., Billa, M., Guerrot, C., et al. (2006). The Palaeoproterozoic Ghanaian province: Geodynamic model and ore controls. Journal of AfricanEarth Sciences, 44(4–5), 432–448.
[3] Papon, A., & Lemarchand, R. (1973). Géologie et minéralisations du sud-ouest de la Côte-d'Ivoire: synthèse des travaux de l'Opération SASCA, 1962-1968. Bulletin de la Direction des Mines et de la Géologie de Côte-d'Ivoire, No. 6; Mémoires du B.R.G.M., No. 80. Éditions du B.R.G.M.
[4] Koffi, A.Y., Baratoux, L., Pitra, P., Kouamelan, A.N., Vanderhaeghe, O., Thébaud, N., Bruguier, O., Block, S., Fossou Kouadio, H.J.L., & Kone, J. (2023). A tectonic model for the juxtaposition of granulite- and amphibolite-facies rocks in the Eburnean orogenic belt (Sassandra-Cavally domain, Côte d'Ivoire). BSGF - Earth Sciences Bulletin, 194, 11.
[5] Camil, J. (1984). Petrographie, chronologie des ensembles granulitiques archéens et des formations associées de la région de Man (Côte d'Ivoire). UnpublishedPh.D. thesis, Université d'Abidjan.
[6] Kouamelan, A.N. (1996). Géochronologie et géochimie des formations archéennes et protérozoïques de la dorsale de Man en Côte d'Ivoire. UnpublishedPh.D. thesis, Université de Rennes I.
[7] Koffi, A.Y., Thébaud, N., Kouamelan, A.N., Baratoux, L., Bruguier, O., Vanderhaeghe, O., Pitra, P., Kemp, A.I.S., & Evans, N.J. (2022). Archean to Paleoproterozoic crustal evolution in the Sassandra-Cavally domain (Côte d'Ivoire, West Africa): Insights from Hf and U-Pb zircon analyses. Precambrian Research, 382, 106875.

[8] Gnagnon Raymond-Stéphane Koffi, Alain Nicaise Kouamelan, Marc Ephrem Allialy, Yacouba Coulibaly, Jean-Jacques Peucat,
Re-evaluation of Leonian and Liberian events in the geodynamical evolution of the Man-Leo Shield (West African Craton),PrecambrianResearch,Volume 338,2020,105582,ISSN 0301-9268,https://doi.org/10.1016/j.precamres.2019.105582.(https://www.sciencedirect.com/science/article/pii/S0301926819301044)
[9] Thébaud, N., Masurel, Q., Parra-Avila, L., Eglinger, A., & Perret, J. (2026). Transpressional flow and escape of orogens: The Paleoproterozoic Eburnean accretionary orogen of West Africa. Journal of Structural Geology, [in press].
[10] Whitney, D.L., & Evans, B.W. (2010). Abbreviations for names of rock-forming minerals. American Mineralogist, 95(1), 185–187.
[11] Pouchou, J.L., &Pichoir, F. (1991). Quantitative analysis of homogeneous or stratified microvolumes applying the model "PAP". In: Electron Probe Quantitation (pp. 31–75). Springer.
[12] Leake, B.E., Woolley, A.R., Arps, C.E.S., et al. (1997). Nomenclature of amphiboles: Report of the Subcommittee on Amphiboles of the International Mineralogical Association. Canadian Mineralogist, 35, 219–246.
[13] Morimoto, N. (1988). Nomenclature of pyroxenes. Mineralogical Magazine, 52, 535–550.
[14] Carignan, J., Hild, P., Mevelle, G., Morel, J., Yeghicheyan, D., 2001. Routine analyses of traceelements in geological samples using flow injection and low pressure on-line liquidchromatography coupled to ICP-MS: a study of geochemical reference materials BR,DR–N, UB–N, AN–G and GH. Geostandards Newsletter 25, 187–198.
[15] Sun, S.S., & McDonough, W.F. (1989). Chemical and isotopic systematics of oceanic basalts: Implications for mantle composition and processes. Geological Society, London, Special Publications, 42(1), 313–345.
[16] KOFFI, G.R.-S. (2020). Re-evaluation of geochemical and geochronological orogenic events in the Archean domain of Côte d'Ivoire: implications for the geodynamics of the West African Craton. PhD thesis, Université Félix HOUPHOUET-BOIGNY, Abidjan, Côte d'Ivoire, 283 p.
[17] Middlemost, E.A.K. (1994). Naming materials in the magma/igneous rock system. Earth-Science Reviews, 37, 215–224.
[18] Barker, F. (1979). Trondhjemites, dacites, and related rocks. Developments in Petrology, 6, Elsevier, 659 p.
[19] Barker, F., & Arth, J.G. (1976). Generation of trondhjemitic-tonalitic liquids and Archean bimodal trondhjemite-basalt suites. Geology, 4(10), 596–600.
[20] Traoré, H., et al. (2025). Crustal to Microscale Strain Partitioning during Transpression and Control on Ore Formation: Insights from the Paleoproterozoic Séguéla Shear Zone, Southern West African Craton. Tektonika, [in press].
[21] Kouadio, F.J.L.H., Kouamelan, A.N., Ouattara, A.S., &Djro, S.C. (2025). The orthogneisses and paragneisses of Sassandra-Cavally (SASCA) domain (Côte d'Ivoire, West African Craton): Some Birimian crustal segments with a strong archaic signature. Journal of Geology and Mining Research, 16(2), 16–37.